THE NUN ORCHID.

MISSOURI

BOTANICAL GARDEN

TWENTY-SECOND ANNUAL REPORT

ST. LOUIS, MO.

PUBLISHED BY THE BOARD OF TRUSTEES

1911

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OF THE MISSOURI BOTANICAL GARDEN.

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A. D. CUNNINGHAM, Secretary.

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* *Ex-Officio.*

[1] Elected to membership January 11, 1911, to fill a vacancy caused by the death of David F. Kaime, one of the Trustees designated by Mr. Shaw.

[2] Elected President of the School Board October 11, 1911, to succeed Christopher W. Johnson, who had held that office for one year.

STAFF
OF THE MISSOURI BOTANICAL GARDEN.

Director,
WILLIAM TRELEASE.

GEORGE T. MOORE,
Plant Physiologist.

HERMANN VON SCHRENK,
Plant Pathologist.*

Research Assistant.

CORA J. HOGAN,
Curator of Library.

MOSES CRAIG,
Curator of Herbarium.

CHARLES O. CHAMBERS,
WILLIAM H. EMIG,
L. O. KUNKEL,
JACOB SCHRAMM,
MILDRED W. SPARGO,
Rufus J. Lackland Research Fellows.

HENRY C. IRISH,
Superintendent.

JAMES GURNEY,
Head Gardener. †

JOHN BANNES,
Foreman. †

ADOLPH JAENICKE,
Foreman.

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* *Honorary.* † *Emeritus.*

PREFACE.

Under direction of the Board of Trustees, the twenty-second annual report of the Missouri Botanical Garden is presented to the public.

The twenty-first report, of 1910, was issued on December 23, 1910, which marks the date of publication of the scientific papers that it contains.

These reports are sent to scientific institutions and journals in exchange for publications and specimens desirable for the library, herbarium, laboratories or living collections of the Garden. So far as is possible, reprints of the botanical papers that they contain are sent to botanists occupied with a study of the subjects to which they pertain.

Any of the Garden publications not out of print may be purchased, at approximately the cost of publication, from Messrs. R. Friedländer & Sohn, Berlin, Germany; W. Wesley & Son, London, England; or the undersigned.

WILLIAM TRELEASE.

ST. LOUIS, MO., December 27, 1911.

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REPORTS FOR THE YEAR 1910.

REPORT OF THE OFFICERS OF THE BOARD.

SUBMITTED TO THE TRUSTEES JANUARY 11, 1911.

To the Board of Trustees of the Missouri Botanical Garden:

We submit for your consideration the financial results for the year ending December 31st, 1910.

The receipts from rentals in 1910 were $2,743.61 less than the previous year, the result of a number of vacancies in the properties of the Board, some of them for almost the entire year, but most of them were filled during the year, and all are now occupied except two, which no doubt will be rented within a short time. Our loss in rentals through vacancies amounted to $8,406.00, and $167.00 was charged off as uncollectable,—about one-eighth of 1 per cent of the total earnings.

The above mentioned vacancies, seven in number, necessitated an unusually large expenditure for repairs, as all were old buildings from 40 to 70 years of age, and had been almost continuously occupied for many years. All have been put in good condition, and the rest of the income property has received necessary repairs.

Several leases expiring during the coming year have been renewed at a large increase in rentals, and we feel assured of a gain of at least $15,000 in rentals for the year 1911 over those of the year 1910.

We have disposed of 270 feet on Flora boulevard for the sum of $19,600.00.

The Board are the owners of much vacant unimproved residence property on the south side in proximity to the Garden, and as the demands for street improvements have

become a serious matter, and at times a burden to the trust, the Board decided in June last to improve a portion of a tract containing 30,000 front feet, lying just west of Grand avenue between Shaw and McRee avenues, and during the summer the full improvement of a portion of it, containing 8,400 front feet, was begun, and is almost finished, at a cost of about $50,000, but too late to market it, although 1,136 front feet have already been sold at an average of $50.00 per front foot. We have also sold, to the Board of Education, almost an entire block in the western portion of the same tract, containing 1,314 front feet, at $50,000, upon which a large school building will be erected in the near future.

We have expended during the year the following sums for street improvements, and the amount has been charged to real estate as a betterment:

Shaw avenue	Roadway	$14,125 38
Vandeventer avenue	Roadway and sidewalks	7,866 62
Klemm street	Roadway	10,194 44
McRee avenue	Sidewalks	519 76
Magnolia avenue	Sidewalks	400 88
Alley, City Block 4930		998 95
Alley, City Block 4935		1,433 29
Alley, City Block 4919		173 18
Lafayette avenue addition		35,500 38
Total		$71,212 88

A number of streets upon which the Board own property are either under construction, or will be in the spring, and will require an expenditure of approximately the following sums:

Lawrence street	Roadway	$10,000 00
McRee avenue	Roadway	15,000 00
Portis avenue	Roadway	2,000 00
South Kingshighway	Roadway	10,000 00
Arsenal street	Roadway	7,000 00
		$44,000 00

No permanent improvements have been made at the Garden, but $2.781.16 was expended for metal cases, furniture, etc., for the new Library Building.

The following amounts have been credited to the Stock Account for the year:

Library	$5,604 20
Herbarium	3,943 05
Library building furnishings	2,000 00

The annual bequests provided for in Mr. Shaw's will, with the exception of the Trustees' Banquet, have been met by the expenditure of $981.82, but the full amounts authorized, $2,100.00, have been charged against the year's income, to be used at some future time.

The Board has been called upon within the past year to mourn the loss of two Presidents, both members of the original Board appointed by Mr. Shaw:

Mr. Rufus J. Lackland, President from October 14th, 1889, to January 12th, 1910, who died February 28th, 1910, in his ninety-first year; and Mr. David F. Kaime, Vice-President from 1902 to February 9th, 1910, and President from that date to the time of his death, October 24th, 1910.

These gentlemen for years devoted much time and attention to the administration of the trust devised to them and their associates, and the Board passed the following resolutions of respect to their memory:

The Trustees of the Missouri Botanical Garden desire collectively and individually to place on permanent record a minute of their grateful appreciation of the life and services of Rufus J. Lackland, who died February 28th, 1910, in the ninety-first year of his age.

It is not theirs to dwell upon the great worth and exceeding usefulness to St. Louis of his long life as a citizen and a business man. They, with every one else, recognize that in these relations he stood for the right, four square to every wind that blows. Nor did he only stand against the storms, but he moved to meet and beat them back, and in such work he did never

"bate one jot of heart or hope,
but still bore up and steered right onward."

But it is for them to bear concordant witness to his dutiful devotion to the interests of the Missouri Botanical Garden, over which he and they were placed in custodianship.

Named as one of the original Trustees in the Will of Mr. Shaw, and chosen by his associates to be President of the Board of Trustees at their first meeting, Mr. Lackland remained such Trustee and President for twenty years, and until within two months of his death.

Sagacious in his counsels, watchful in his care, diligent and punctual in duty, wise in his suggestions for direction of his associates in the Board, and patient in his submission, if, on frank and full discussion, their decision went against him, with simplicity, sincerity, integrity and fidelity, the crowning characteristics of his days of activity and his nights of rest, his Presidency of a score of years largely made it that the history of this Board of Trustees has been one flowing stream of harmony and efficiency.

To him, the aged veteran,
To him, the kindly friend,
To him, the sturdy Trustee,
To him, the faithful President,

the Trustees desire to say, and to place on record, their grateful, their affectionate and their reverent Good-By.

ST. LOUIS, MO., April 13th, 1910.

David F. Kaime, a member of the original Board selected by Henry Shaw, had perhaps a closer personal and business relation with Mr. Shaw than any other man who has been connected with the trust. He was for many years his personal friend and confidential business adviser. He became one of his agents in 1867, and continued to act for him in a business capacity until the time of Mr. Shaw's death, in 1889; during the whole of that period, enjoying the closest social relations and intimate friendship. The services that Mr. Kaime rendered to Mr. Shaw must have been very great. It is undoubtedly true that in many ways he was instrumental in promoting the acquisition by Mr. Shaw of the greater part of the downtown real estate, which has increased greatly in value since Mr. Shaw's death.

At the organization of the Board of Trustees of the Missouri Botanical Garden, Mr. Kaime was made a member of the Garden Committee, and continued to serve on that Committee with great discretion and judgment until his election to the Presidency, on February 9th, 1910.

Mr. Kaime always took great interest in the affairs of the Garden and the administration of the trust, and discharged all his duties with rare fidelity and intelligence. He seldom missed a meeting either of the Committee or of the Board. He was always ready to give the benefit of his long experience and mature and wise judgment to every problem presented either to the Committee or to the Board as a whole.

Mr. Kaime served only a short time as President of the Board. He discharged the duties of this office with the same fidelity and cour-

tesy which marked the discharge of his duties as Trustee. His cordial manner and considerate treatment of his associates endeared him to them personally.

In the light of his long and distinguished service, the Committee recommends to the Board the adoption of the following resolution:—

> RESOLVED, that the Trustees of the Missouri Botanical Garden deeply regret the passing away of their associate Trustee and President, David F. Kaime, and express to his bereaved family their deep and heartfelt sympathy in the loss which they share with the community.
>
> In Mr. Kaime's death, the Trustees have been deprived of one of their most experienced and valuable members and advisers, and a genial and whole-souled friend. The results of his efficient services to the Board will be felt while the great trust created by Henry Shaw continues to exist. His kindly presence and steadfast strength of character will remain with the members of the Board of Trustees, with whom he was so long associated, as a tender memory during their lives; and the community which he has benefited by his many gratuitous and valuable services will hold him always in grateful recollection.
>
> RESOLVED, that an engrossed copy of this minute and resolution be transmitted to Mr. Kaime's family as a fitting, though inadequate, tribute to the esteem in which he was held.

ST. LOUIS, MO., December 14th, 1910.

After charging against the income all the disbursements, except $71,212.88, expended for street improvements, we are able to carry forward as a surplus for the year the sum of $10,995.94.

RECEIPTS.

Rentals	$136,847 77	
Interest and dividends	1,994 90	
Garden handbook sales	215 25	
Publication sales	8 58	
Garden collection	9 50	
Total income receipts		$139,076 00
Sales of real estate under decree	94,278 00	
Bills receivable account, real estate	380 00	
Shaw School of Botany, rentals	3,900 00	98,558 00
Total receipts		$237,634 00
Cash on hand December 31st, 1909		7,029 98
		$244,663 98

DISBURSEMENTS.

Garden Account,		
Labor pay-roll	$23,776 37	
Students' pay-roll	2,105 47	
Office assistance	1,575 00	$27,456 84
Fuel		2,324 26
Water		619 00
Repairs and supplies	2,451 47	
Stable and implements	292 20	
Plants and seeds	459 31	
Total for care of Garden		$33,603 08
Herbarium Account,		
Salaries	1,080 00	
Fuel	307 90	
Current expense and additions	1,664 15	3,052 05
Library Account,		
Salaries	2,567 42	
Fuel	410 52	
Current expense and additions	2,779 47	5,757 41
Garden Office Account,		
Salaries	5,795 30	
Fuel	282 24	
Current expense	751 58	6,829 12
Research and instruction,		
Salaries	7,324 51	
Fuel	282 26	
Current expense and instruments	1,931 67	9,538 44
Total Garden maintenance		$58,780 10
Garden Improvement,		
Library and fittings	781 06	
Herbarium cases	1,000 00	
Equipping lecture room	1,000 00	
Removing tool house	249 77	
New boiler	353 80	
Sewer connections	100 00	3,484 63
Total amount expended on Garden		$62,264 73
Publication Account,		
Twenty-first Annual Report	1,881 64	1,881 64
Carried forward		$64,146 37

Brought forward		$ 64,146 37
Property Account,		
State, school and city taxes	34,021 63	
Streets, sidewalks and sewers . . .	73,006 45	
Insurance	4,678 38	
Repairs	9,856 74	
Improvements	185 00	121,748 20
Bequests,		
Annual Flower Sermon	$ 200 00	
Annual Flower Show	372 00	
Annual Gardeners' Banquet	409 82	981 82
Sundries,		
Office expenses	6,682 56	
Legal and professional services . .	413 35	
Commissions	3,102 13	10,198 04
Shaw School of Botany, rentals	3,863 25	3,863 25
Total Disbursements		$200,937 68
Cash balance December 31st, 1910 .		43,726 30
		$244,663 98

Respectfully submitted,

EDWARDS WHITAKER, President.

Attest:

A. D. CUNNINGHAM, Secretary,

TWENTY-SECOND ANNUAL REPORT OF THE DIRECTOR.

SUBMITTED TO THE TRUSTEES JANUARY 11, 1911.

To the Board of Trustees of the Missouri Botanical Garden:

The following report on the Missouri Botanical Garden and the School of Botany therewith connected is respectfully submitted, in compliance with your rules.

GARDENING.

No considerable changes in the ground allotted to decorative plants are to be reported, though rearrangements of detail and selection of varieties have enabled the gardeners to secure a rather more attractive general effect and a decidedly better persistence of color masses through the season.

As has been the practice for some years past, the sunken garden was occupied by early-flowering tulips, flanked this year by the later Darwin and parrot types; and in this display some 28,800 bulbs, representing 222 varieties, were used.

During the summer and early fall, the same ground was occupied by choice bedding-plants. Among the forms utilized this season Alternanthera (5,000), Sedum (4,000), Echeveria (4,000), Pelargonium (3,000), Coleus (2,500), Celosia (1,800), Peristrophe (1,800), Gladiolus (1,500), Antirrhinum (1,500), Canna (1,200), Sweet Alyssum (1,200), Salvia (1,000), Ageratum (1,000), Pansies (1,000), etc., figured prominently. For this and similar purposes 38,000 plants were used,—about 5,000 more than in 1909.

Through the fortnight beginning with November 14th, the parterre was occupied by a tented display of 2,250 chrysanthemums, representing 502 varieties, which in perfection of

THE CAPE DAISY.

growth, effectiveness of grouping, and the number of exceptionally large plants has not before been equaled at the Garden.

As in the preceding year, Oenotheras have been grown in large numbers, from seed of known parentage, primarily as material for continued investigation by Dr. Gates. About 4,000 of these plants, representing 70 forms, of which 39 were pure races and 31 artificial hybrids, were carried through the season.

Plant and seed additions for the year may be tabulated as follows:

	Accessions	Plants or Packets	Value
Bought	32	5,624	$ 459.31
Presented	262	5,572	407.71
Collected by employees			
In the Garden	1	2,950	513.30
Elsewhere	22	1,924	156.03
	317	16,070	$1,536.35
Cuttings raised	1	17,103	855.15
Seedlings raised	1	31,513	2,205.91
	319	64,686	$4,597.41

The exchange seed list issued at the beginning of the year included 2,643 species and varieties; and 9,538 packets of seeds, valued at $476.90, have been distributed to correspondents who made selections from the list. Living plants to the number of 277, valued at $35.40, have been distributed to exchanging institutions.

Apart from the regular exchanges, 520 surplus plants, valued at $57.35, have been presented to schools and colleges for educational use; and 727 plants, removed from the ground on the approach of winter or remaining after the spring planting, were given to charities. On the conclusion of the chrysanthemum show, 2,500 cut flowers were distributed among the hospitals, etc., through the kindly intermediary of the Flower Committee of the Eighth District of Women's Clubs.

PLANTS CULTIVATED.

Species or varieties to the number of 900 were added to the living collections in the course of the year, and 590 forms were lost or discarded, making a net gain of 310, and bringing the total recorded as now in cultivation to 12,074, in contrast with the 11,764 noted for 1909.[1] These forms represent 1,820 genera, belonging to 203 natural families,[2] a net addition of 43 genera and 6 families.

Classified as to hardiness and other features of gardening interest, the collection now comprises

Thallophytes (Agaricaceae)		**5**
Bryophytes		**10**
Pteridophytes		**214**
Spermatophytes		
Gymnosperms		
Cycads		**30**
Conifers		**111**
Angiosperms		
Trees and shrubs	**1,715**	
Hardy and annual herbs	**3,857**	
Tender plants		
Orchids	**659**	
Other Monocotyledons	**1,840**	
Dicotyledons	**3,633**	**11,704**
		12,074

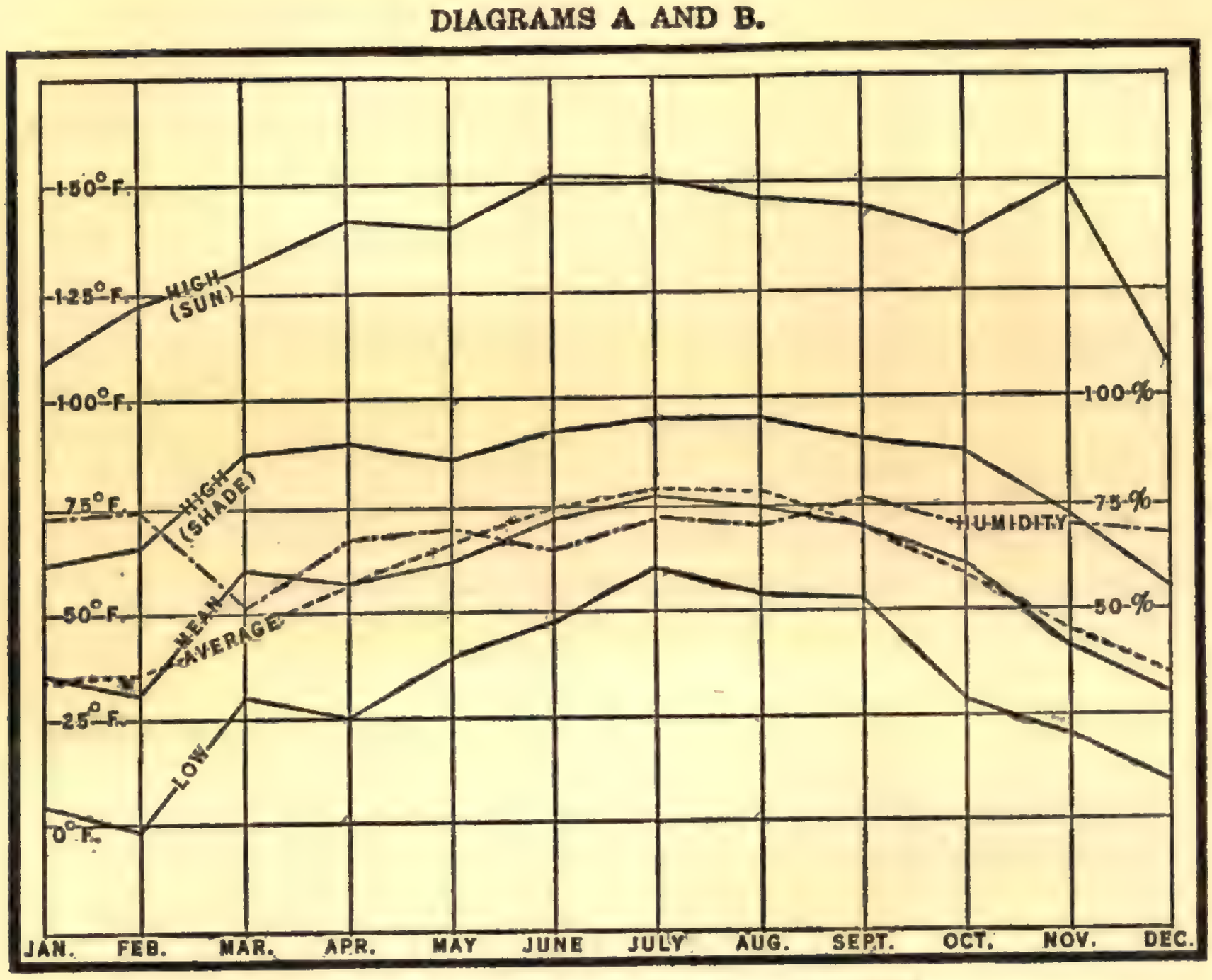
THE WEATHER.

The season just closed (diagrams A and B) has varied from the average in several respects,—on the whole unfavorably. Through most of the year the mean monthly temperature ran somewhat below the St. Louis average, exceeded materially only in March; but though the daily mean for April was normal, the month was marked by a severe freeze which wrought serious havoc with plants, all of which were in

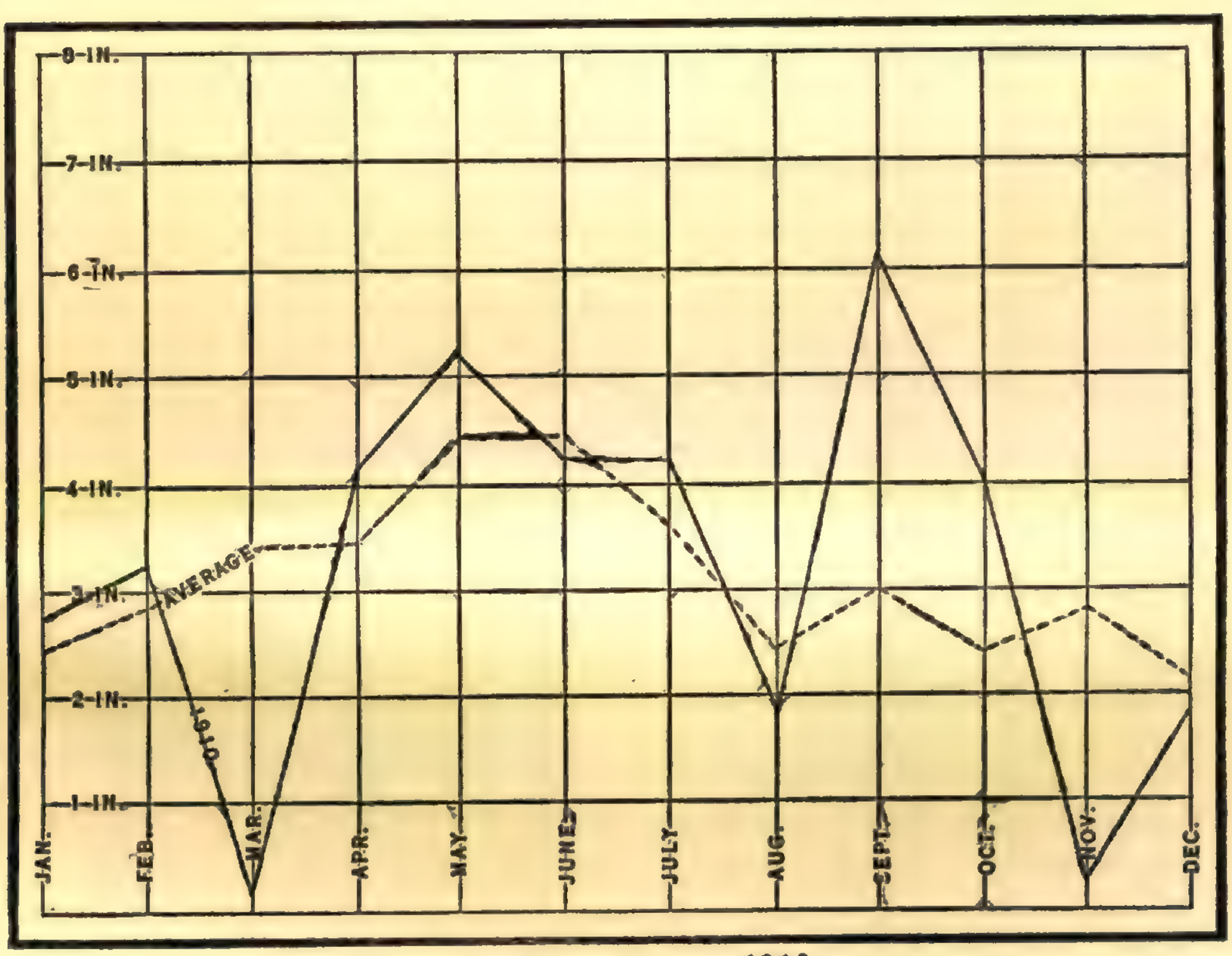
[1] Rept. Mo. Bot. Gard. **21**: 12.

[2] See list in Rept. Mo. Bot. Gard. **21**: 12. — Two families lost (Empetraceae and Loranthaceae). Eight families added (Callitrichaceae, Ceratophyllacae, Datiscaceae, Frankeniaceae, Globulariaceae, Goodeniaceae, Isoetaceae, and Trochodendraceae).

DIAGRAMS A AND B.



A.—TEMPERATURE AND HUMIDITY, 1910.



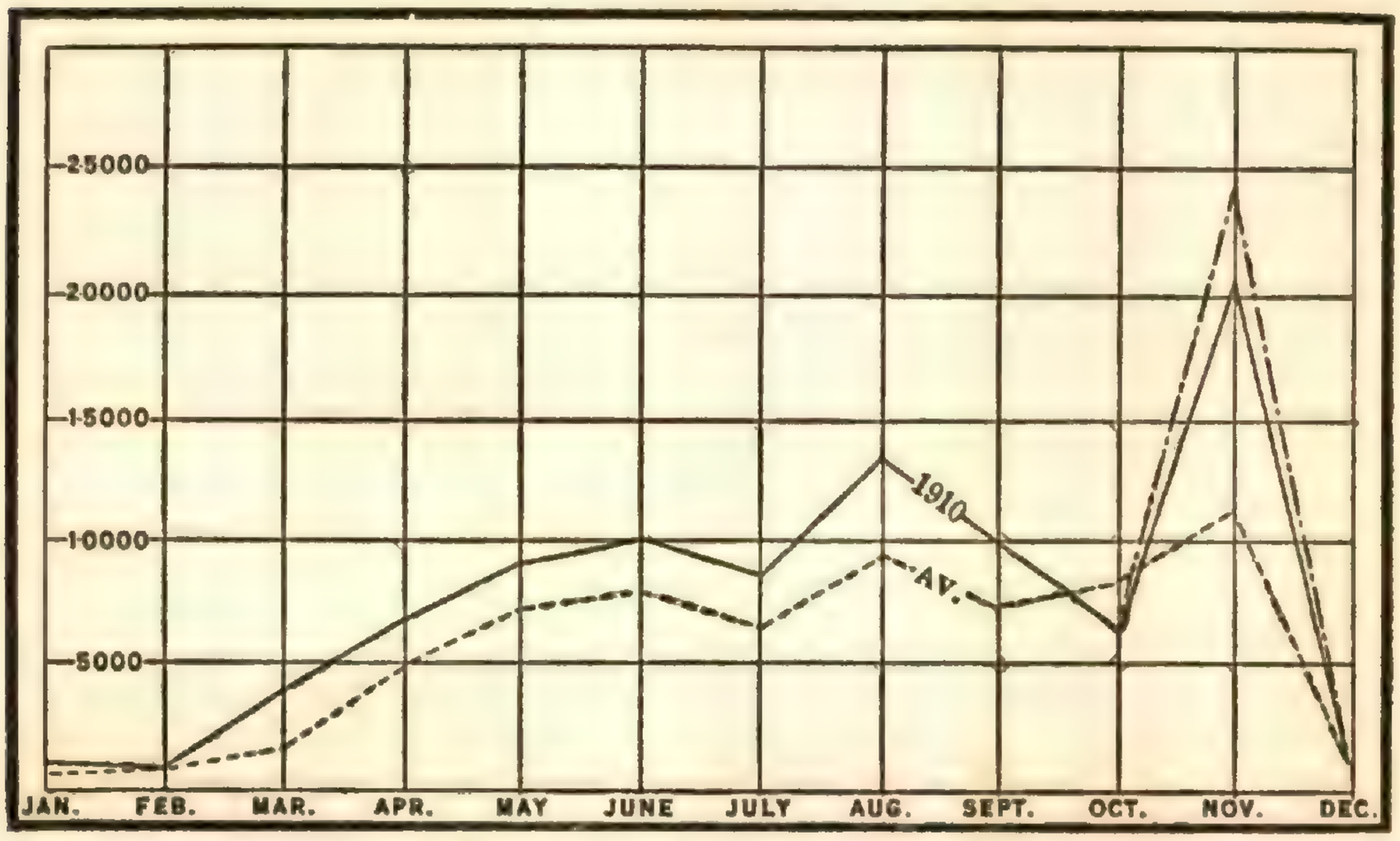
B.—PRECIPITATION, 1910.

full vegetation. The total precipitation (37.3 in.), though extremely close to the normal (37.4 in), departed from this in severe droughts in March and November and in a very marked excess of rainfall in September and October,—the spring drought, in conjunction with the unusual warmth, affecting vegetation unfavorably, while the early fall rains lessened the number of visitors to the Garden.

VISITORS.

I am again able to report an increase in the number of week-day visitors, of whom 91,914 were counted at the gates.

DIAGRAM C.



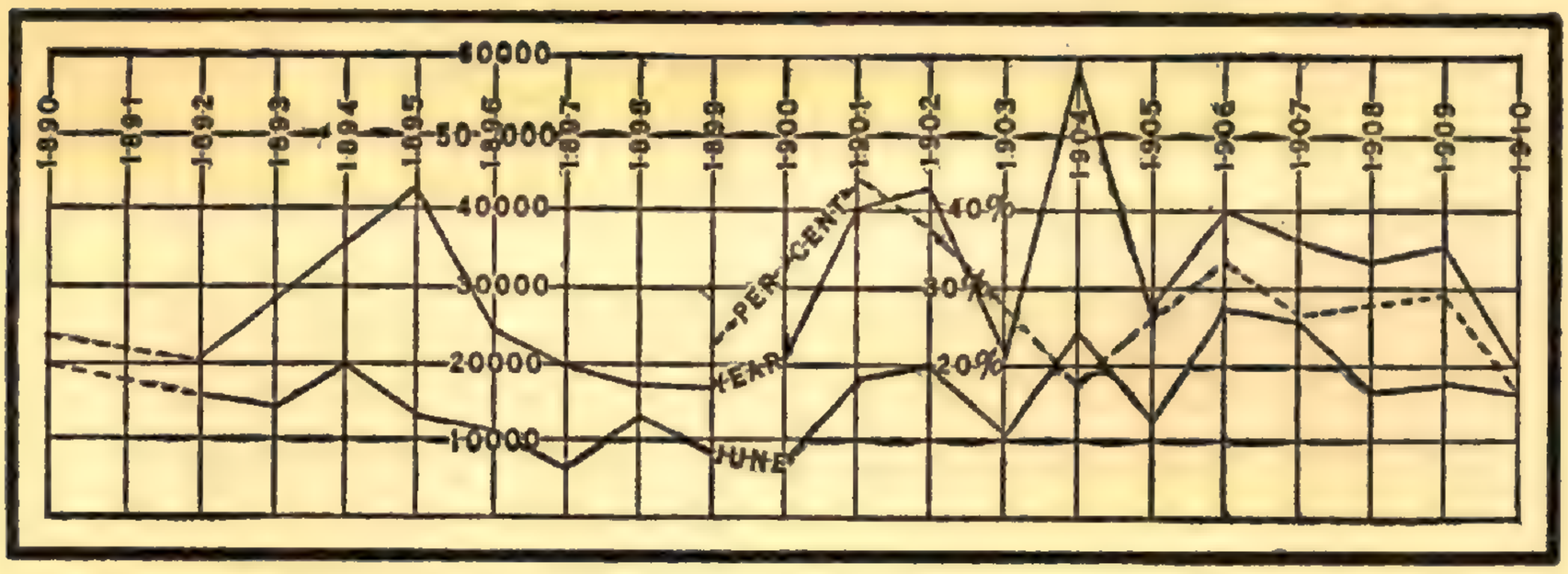
WEEK-DAY VISITORS, 1910.

Of this number, 19,377 were attracted by the display of chrysanthemums, which was again made accessible to the public in the evening through the courtesy of Captain Robert McCulloch in providing means of lighting the tent. Notwithstanding this gratifying increase in the number of week-day visitors, the total number for the year falls about nine thousand behind the corresponding total for 1909, because of stormy weather on the first Sunday in September. On the

IN THE HERBARIUM.

June "open Sunday," about the average number was recorded,—17,406, but on the September Sunday the approximately equal average was met by a record of only 2,297, bringing the Sunday visitors for the year to only 19,703, and the total for the year to 111,617. The distribution of week-day visitors through the season, as compared with the previous average, and the relation of the 19,703 Sunday visitors to those of earlier years, and to the total for this year (17.6%), are indicated in diagrams C and D.

DIAGRAM D.



SUNDAY VISITORS, 1890 TO 1910.

An interesting feature of the year, which brought unusually distinguished—if few—visitors, was a meeting of the National Academy of Sciences, held in the graduate lecture-room of the Garden on the eighth, ninth and tenth of November.

THE HERBARIUM.

Additions to the incorporated herbarium number 26,287 sheets of specimens, of which 10,908, valued (unmounted) at $545.40, were presented or received by way of exchange; 1,572, valued at $78.60, were collected by employees; and 13,807 were purchased, the Secretary's books showing an expenditure during the year of $1,664.15 for specimens and material. Exchange distributions comprise 545 unmounted specimens, valued at $27.25.

Apart from a relatively small amount of unincorporated material, the herbarium now consists of:

The Engelmann Herbarium (all groups)			**97,859**
The General Herbarium:—			
Higher plants.			
The J. J. Bernhardi Herbarium .	**63,705**		
The Henry Eggert Herbarium .	**26,704**		
The J. H. Redfield Herbarium .	**16,447**		
The Sturtevant and Smith Herbarium	**7,446**		
The Gustav Jermy Herbarium .	**5,118**		
The A. W. Chapman Herbarium	**3,536**		
The Julien Reverchon Herbarium	**17,210**		
The Nicholas Riehl Herbarium .	**3,359**		
Other specimens	**383,938**	**527,463**	
Thallophytes.			
The J. J. Bernhardi Herbarium	**4,429**		
The Gustav Jermy Herbarium .	**1,659**		
The S. M. Tracy Herbarium .	**4,393**		
The Wm. Trelease Herbarium .	**11,000**		
Other specimens	**35,309**	**56,790**	
Making a total of		**682,112**	
Valued at			**$102,316.80[3]**

Supplementing the herbarium and the shelved or incorporated exsiccatae which are here counted as a part of it,[4] the Garden possesses specimens of economic plant-products, woods, seeds, etc., valued at $280.00, and 1,851 listed preparations for microscopic study, valued at $410.00, which have not been added to since their enumeration in my last report.[5]

For the protection of the very valuable exsiccatae, steel cases corresponding in essentials of design and construction with those used for the regularly mounted herbarium, but of half the standard depth and with adjustable shelves, have been secured this year, and preparations have been made for a systematic enlargement of the collection of microscope slides, and their arrangement in steel cabinets of approved design.

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[3] **This valuation at the rate of $15.00 per hundred mounted sheets.**

[4] **Rept. Mo. Bot. Gard. 16: 21.**

[5] **Rept. Mo. Bot. Gard. 21: 18.**

THE LIBRARY.

Additions to the library number 1,622 books; 2,290 pamphlets; 2 manuscripts; and 51,723 index cards. Of these, 1,013 books, valued at $2,082.00, 2,158 pamphlets, valued at $372.55. and 2 manuscripts, valued at $52.00, were received by gift or in exchange; and 609 books and 132 pamphlets were bought, the Secretary's statement showing an expenditure of $2,580.42 for purchases and binding. Of the index cards, 41,173 were written by employees, and 10,550 were purchased.

The serial publications now received number 1,467; of which 1,363, issued by 982 institutions or publishers, are received in exchange for Garden publications, and the remaining 104 are bought. The number now reported is three more than that noted a year ago.

The Library now contains:

Pamphlets			38,491
Books			27,075
	65,566,	valued at	$101,217.76
Manuscripts	110,	" "	1,590.00
Total	65,676	" "	102,807.76
Index cards	771,100	" "	7,711.00
Total valuation			$110,518.76

GARDENING INSTRUCTION.

No essential changes have been made in the course in gardening since this was last outlined[6] and pupils and teachers remain as at the end of last year, except that early in the season, on nomination of the State Horticultural Society, Mr. Peter Pfaender was granted the scholarship previously held by Mr. Jesse Tuggle.[7] In March next two of the present holders of scholarships will have completed their work, and the customary announcement of vacancies will be made in the

[6] Rept. Mo. Bot. Gard. 20:32.
[7] Rept. Mo. Bot. Gard. 21:23.

course of the winter, so that the scholarships may be re-awarded promptly in the prescribed manner.

UNDERGRADUATE INSTRUCTION.

Undergraduate work in the School of Botany has been changed little from what was reported at the end of last year.[8] Such modifications as have been made are intended to lay a firmer foundation of precision and method in elementary work as a stepping stone to advanced and professional courses, without detracting from its interest or suitableness as part of a liberal education for those who may elect it for this purpose only. At the beginning of the present college year Mr. P. L. Gainey assumed the duties of Teaching Fellow in botany, an appointment held last year by Mr. C. D. Learn.

Undergraduate enrollment for the first term of 1910-11 is: Botany 1, thirty; Botany 3, nine; Botany 6, five; Botany 9, five; Botany 10, two; Botany 11, two; Botany 17, four; Botany 19, four; special work in histology, three:—a total of 64 students, each taking one full course in botany.

GRADUATE INSTRUCTION AND RESEARCH.

The provision for advanced instruction and research made in 1909.[9] has been materially increased this year by the establishment of three additional research fellowships, and in memory of the lamented president of the board for two decades, the five have been designated the Rufus J. Lackland Research Fellowships. At the last commencement of Washington University, the Master's degree, in botany, was conferred on Miss Ada Hayden and Mr. E. G. Arzberger,—the holders of fellowships last year—whose theses have been published in the last Garden Report.[10] The holders of the fellowships for the present college year are Miss Caroline

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[8] Rept. Mo. Bot. Gard. 21: 22.
[9] Rept. Mo. Bot. Gard. 21: 22.
[10] Rept. Mo. Bot. Gard. 21: 25, 60.

THE GRADUATE LABORATORY.

Rumbold and Messrs. H. W. Anderson, C. O. Chambers, S. M. McMurran and Jacob Schramm.

Under the guidance of Professor Moore, these five Fellows, the University Teaching Fellow, and three other graduate students are giving a considerable part or all of their time to advanced study and investigation, either in botany alone or with some cognate subject as a minor in compliance with the rules under which higher degrees are conferred by the University. One other graduate, not a candidate for a degree, is also doing advanced work in the Garden laboratory.

Such time as could be spared from other and necessary duties has been given by myself, Professor Moore and Dr. Gates to original work, some of the results of which have been published.

As in earlier years, the facilities of the Garden have been made accessible to visitors desiring to use them; and during the year just closed 15,308 herbarium specimens have been loaned to 21 persons; and 100 books or pamphlets, to 24 persons not living in St. Louis, in addition to 298 loaned to 56 residents of the city. Information, transcripts from the library, etc., have also been given to many inquirers, through an extensive corespondence. The most important work done at the Garden this year by a person not connected with its own staff was a series of physical, chemical and bacteriological examinations of the milk supply of the poorer parts of the city, with special reference to its influence on the health of little children, made for the School of Social Economy, under the auspices of the Russell Sage Foundation, by Miss Elizabeth Moore.

THE GARDEN STAFF.

No noteworthy changes have been made in the regular staff of library, herbarium and garden, except that because of advancing age Mr. John Bannes, long acting as foreman of the grounds, has been relieved of general responsibility—though continuing his work with the title of foreman emeritus,—the active foremanship being assumed by Mr. Otto

Bogula,—a former garden pupil, subsequently broadly trained and experienced in responsible work both in this country and abroad.

SPECIAL TESTAMENTARY PROVISIONS.

Three of the annual events provided for in the will of Mr. Shaw have taken place in 1910.

The flower sermon was preached in Christ Church Cathedral, St. Louis, on the morning of May 22 by the Right Reverend Charles P. Anderson, Bishop of Chicago.

The sum set apart for floral premiums was once more entrusted to the St. Louis Horticultural Society for award in connection with an exhibition held early in November: no award was made of the Shaw medal.[11]

The twenty-first banquet to the gardeners of the institution and invited florists, nurserymen and market-gardeners was given at the Southern Hotel on the evening of August 11th, 1910, the Director of the Garden presiding. There were present 129 persons. Following the dinner, speeches appropriate to the occasion were made by Hon. J. H. Gundlach, Acting Mayor of St. Louis; President J. W. Stanton of the American Apple Growers' Congress, which was then meeting in St. Louis; President L. A. Goodman of the American Pomological Society; Professor C. H. Dutcher, representing the State Horticultural Society and the State Board of Horticulture; Secretary J. T. Stinson of the State Fair; Professor W. B. Alwood, of the United States Department of Agriculture; President W. P. Stark of the American Association of Nurserymen; Secretaries Mayo Fesler and Roger Baldwin of the Civic League of St. Louis, and Hon. C. P. Walbridge.

Very respectfully,

WILLIAM TRELEASE,
Director.

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[11] Rept. Mo. Bot. Gard. **5**:18. **9**:19. **11**:20. **16**:29. **19**:23.

SCIENTIFIC PAPERS.

ILLUSTRATED STUDIES IN THE GENUS OPUNTIA—IV.

BY DAVID GRIFFITHS.

Among a thousand members of the genus *Opuntia* collected between Ejutla and the Canadian boundary, now in cultivation, the following appear not to have been previously described:

Opuntia Bentonii, sp. nov.

An open-branching, erect species, closely resembling *O. Lindheimeri* in habit; joints distinctly obovate, 17 to 18 by 27 to 28 cm. (last year's growth), thin, with vascular system distinctly traceable for two or three years, dull dark green; areoles elliptical to obovate, 5 to 6 mm. long, tawny when young but soon becoming black; leaves subulate, cuspidate-pointed, recurved, 5 mm. long; spicules yellow, unequal, scattered in upper portion of areole and fringing it or scattered through its entire area; spines not numerous, confined to an irregular distribution on edges of joints, yellow, annular, translucent, bonelike, flattened, erect to recurved, 1 to 4 or 5, longest 2½ cm. long and others shorter; flowers light yellow, large, 9 to 10 cm. in diameter, petals broadly obovate, rounded, mucronate, filaments greenish yellow, pistil 3 cm. long, style greenish white, stigma yellowish green, 7-parted; ovary obovate, slightly tuberculate when young, about 5 cm. long, with sub-circular areoles 2 to 3 mm. in diameter, bearing yellow spicules and a few fugacious, yellow, delicate spines; fruit obovate-pyriform, purplish red throughout, insipid, umbilicus broad, flat, slightly raised to slightly depressed with a slight pit in center.

The species is most closely related to *O. texana*, but differs in shape, thickness and texture of joints, distribution and number of spines, and other minor details. It has turned up frequently during the past six years from Fernandina, Florida, to the mouth of the Brazos, always in cultivation in the eastern portion of this range and native in southwestern Louisiana and Texas. The first collection of it was made at McClenny, Florida, April 26, 1906, by Mr. Harmon Ben-

ton. This collection has been grown by vegetative propagation since. The last planting was made in the spring of 1908, and plants from this setting with single-joint cuttings bloomed profusely the second year and at the end of the fourth season's growth are about four feet high and seven to eight feet in diameter. It is perfectly hardy at San Antonio, Texas, but at the beginning of the fourth growing season showed signs of decay of central joints, indicating a breaking down, more or less common, which precedes in many cases a more rapid decay resulting in the death of the main trunk. This simply is an indication that the species in this situation is not long lived. It is a common phenomenon in many introduced species.

The type specimen is one prepared April 24, 1910, from a cultivated specimen, numbered 8374 D. G., and collected originally by Harmon Benton at McClenny, Florida, April 26, 1906.—Plates 1 and 2.

Opuntia Gregoriana, sp. nov.

An erect, quite compactly branched, grayish green plant, a meter or more high, 1½ meters or more in spread of branch; joints obovate, glaucous, with a tinge of purple about the upper marginal areoles, about 14 by 21 cm. and again 12 by 17 cm. and even smaller than this, uniform in general outline; areoles brown, prominent, but not protruding much, ovate to obovate, about 3 mm. long on sides of joints but sub-circular and often 6 mm. long on edges, even in current year's growth, increasing some in size with age; spicules unequal, scattered through entire areole but more numerous above, variable, the longest about 6 mm., not increasing much after first year, often becoming 1 cm. long at tip of joint, yellow, but sometimes brownish tinged; spines not numerous, confined to edges and upper areoles of joints, 1 to 3 and at times as high as 6, yellowish or bleached, white distally with translucent tips and tinted bases, flattened, sometimes twisted, not annular or at most only very faintly so, commonly 3 cm. long but ranging from 1 to 4 cm.; flowers yellow; fruit deep purplish red all the way through, obovate to pyriform, slightly pitted at apex with sub-circular, tawny, remote areoles bearing a tuft of unequal, centrally-located spicules 3 or 4 mm. long, about 4 by 7 cm.

The species should probably be classed with *O. Engelmannii,* but the joints are very distinct in outline and the spines are few in number for this group.

The type was prepared at Chico, California, September 9, 1911, from cultivated specimens collected near El Paso, Texas, July 29, 1905. Both the type specimen and the original collection bear my serial number 8020. Two generations of this have been grown by vegetative propagation since its collection.—Plate 3.

Opuntia incarnadilla, sp. nov.

An erect, compactly-branched, arborescent species with a distinct cylindrical trunk 20 to 30 cm. in diameter, 2 to 3 or 4 meters or more high; joints of a striking blue-green with some bloom in the fall but much brighter in color in the spring, uniformly and regularly obovate, about 15½ by 28½ cm., smooth, flat, broadly rounded above and tapering uniformly below; areoles oval to obovate, 2 to 4 mm. long, enlarging in age to about 6 mm. in diameter, the lower usually unarmed and about 2 cm. apart; wool brown turning gray to dirty black; spicules yellow, very inconspicuous even on old joints when they are slightly darkened, scarcely visible up to 18 months old; spines white with translucent bonelike tips, short, stout, erect or when young bonelike throughout, bent, twisted, flattened, erect or recurved, irregularly distributed, commonly none below, 1 to 2 above and 2 to 4 on edges of the joints, with an occasional joint with entire side armed with 1 to 4, seldom 2 cm. long and from that down to 8 mm., increasing with age on old stems both in length and numbers; fruit bright deep red all through, palatable, oval to subglobose with comparatively large areoles filled with prominent brown wool, a few inconspicuous spicules in the center and 5 or 6 fugacious, delicate spines below which are commonly 6 to 8 mm. long.

The species is characterized by its beautiful blue-green color, uniformity of joint outline, and habit especially. It should be placed with the mansa or large cultivated Mexican species. In California it has made a growth of four feet high by about the same measurement in spread of branch, in four years, and produced a few fruits the third season and a small crop the fourth. At Brownsville, Texas, it is perfectly hardy but does not grow as well, and has not yet produced any fruit, although the plants are the same age as those at Chico, California. The spicules are much more numerous at Brownsville.

The type specimen bears my serial number 8074 and was prepared from cultivated specimens at Chico, California, Sep-

tember 11, 1911. The cuttings from which these plants were grown were collected by myself under the same number at Hepasote, Mexico, August 21, 1905. The description is a compilation of several sets of notes on the cultivated plants. —Plates 4 and 5.

Opuntia vexans, sp. nov.

An arborescent, cylindrical-jointed species with the habit of *O. arborescens* and about equal to that species in stature, reaching in rare instances a height of 3 meters and having a spread of about the same diameter; joints cylindrical, usually more or less curved, somewhat clavate when young on account of the gradual narrowing toward the base, varying in length from 10 to 40 cm., and 2 to 3 cm. in diameter, tuberculate, the tubercles about 5 mm. high and normally 3 cm. long, the upper crest abrupt and less than one-third the entire length, the highest point being at the upper extremity of the areole, the lower slope twice as long or longer and gradual; areoles oval, gray, acutely angled above, 6 to 7 mm. long, enlarging by formation of new structures above, and becoming sub-circular or obovate and 6 mm. or more in diameter, forming mostly a flat cushion 1 to 2 mm. high, at 2 or 3 years of age; spicules yellow, in a small triangular tuft less than 1 mm. long in upper part of areole, not increasing in age; leaves long, cylindrical, subulate, cuspidate-pointed, 1.5 cm. long, usually tinged at tip; spines reddish-brown, with rather close, gray to silvery sheaths, variable, 4 to 10 on current year's joints, increasing to 30 or more in age, erect, diverging in all directions, commonly 4 to 10 mm. long; flowers delicate light purple, 5½ to 7 cm. in diameter when fully opened, inner row of petals 8, obovate-spatulate, rounded to retuse and minutely cuspidate above, filaments greenish purple, more deeply colored distally, style purple, fading below to almost white, stigma white, 7 to 8-parted; fruit dry, obovate, tubercled at first, becoming less so in age but never smooth, greenish yellow when ripe, drying upon the plant and then falling off, obovate, 22 × 35 mm. or subglobose and 22 × 25 mm., armed with the usual bunch of spicules, and 1 to 3 or 4 delicate, fugacious, hairlike spines sheathed at their tips only.

The species belongs to the *O. arborescens* group and is commonly confused with that species, from which it differs in the character of its fruits and tubercles especially, and agrees with it in form and grosser aspects. It is one of the best ornamental species of the group and is readily propagated from cuttings and less so from seed. At Chico, California, it makes two crops of fruit usually, and at San An-

tonio, Texas, either two or three under good cultivation and favorable season. In October, 1911, there were upon our plants in Texas the first crop of dry fruits, the second crop of green fruits with embryos well hardened, and a crop of blossoms. This species appears to be about as prolific in its fruit production in Texas as in California, which is not true of many species. Like many other species of *Opuntia,* this one secretes honey in the axils of its leaves, and in such dry climates as California, where there is no rain during the growing season, globules of honey which finally dry to a brittle, clear pellet of sugar attached to the upper portion of the areole, are conspicuous. Wasps are frequently attracted by this secretion, but the writer has never seen honey bees gathering it.

The plants at San Antonio were set in 1908. At the close of the fourth season they are five to six feet high and have a spread of fully six feet. The species has been grown and studied under four collection numbers. The type specimen is one bearing my serial number 9174, prepared at San Antonio, Texas, May 2, 1910, from plants cultivated from cuttings collected under the same number in Webb County, Texas, March 13, 1908. Native plants have not been seen elsewhere, but the species is frequently cultivated. The description is a compilation of several sets of notes taken from native and cultivated plants.—Plate 6 and plate 7, two right-hand rows.

Opuntia demissa, sp. nov.

A low prostrate or half ascending species, with main branches on edge on ground and others ascending from them, or often no more than 2 joints high; joints subcircular to obovate or oval, often 18 × 28 but often only 15 cm. in diameter, yellowish green with often a touch of bloom, tubercled and coppered when young, but soon becoming smooth and yellowish green; the young tubercles narrow abruptly, elevated below and articulated with a very large slightly flattened subulate leaf about 4 × 12 mm.; areoles subcircular to obovate, very variable in size, often 6 or 7 mm. in diam., but commonly 3 or 4 × 5 mm., tawny changing through dirty gray to black; spicules yellow, variable, 5 mm. long on one-year old joints, scattered but more numerous above; spines white varying from bone-like to brownish at base, flattened,

twisted, often curved in various ways, but more often erect-spreading, commonly about 4, the longest often 4 to 5 cm. long, but mostly 2 to 3 cm., not annular; flowers yellow, the outer sepals always tinged with red and often a blush on the outer ribs of inner perianth segments, always red when closed and greenish red in bud, filaments greenish below and lighter above, style red, stigma green, 6–7 parted, ovary broadly obovate to hemispherical; fruit subglobose to obovate, red.

The species of the region have been much studied and are very difficult of segregation. *Opuntia occidentalis* and *O. littoralis* are generally accepted, although possibly not always correctly interpreted. It appears to me that the best treatment of the species of the immediate vicinity will recognize four, one of which is still undescribed and usually referred to *O. occidentalis.* This, of course, does not include the introduced forms, clumps of which may occasionally be found growing as though wild.

Like so many species of the group, this one is exceedingly variable, but only remotely related to the other species of the region. Its difference in habit alone is sufficient to separate it from either *Opuntia occidentalis* or *Opuntia littoralis* with which it grows.

The description is taken in the main from the type, supplemented from previous notes in or near the type locality. The type specimen was collected east of San Diego, California, April 2, 1909, under my collection number 9647. In previous years, several other numbers of the same thing have been collected in the same locality. It extends back some distance from the coast, from Santa Barbara south. Previous collections show a great variability in size of joints and character of spines.—Plate 8.

Opuntia cyanella, sp. nov.

Plant comparatively compactly branched, spreading with main stems on edge on ground or when vigorous often flat, usually more or less hemispherical; joints large, wavy, seldom flat, commonly pointed at both ends to some extent, commonly 32 × 40 cm., margin more or less irregular on account of the prominent areoles, light blue-glaucous-green, but glossy bright green when young and becoming scurfy brown in age; areoles very large and prominent, somewhat

raised even when one year old and especially so on young growth, rich light to dark velvety brown, becoming dirty brown in age, 4–7 cm. apart, increasing in size with age; spicules yellow, scattered, unequal, 1 cm. in length, at first not numerous but soon becoming very numerous and formidable; spines light yellow, but darker at one year of age, annular, flattened, seldom twisted, divergent, 2.5 cm. long, formidable, 2 to 6, mostly about 4 at one year but becoming longer and slightly more numerous in age; flowers opening at 7 in the morning, fully opened by 8, dark red at first, but changing gradually to deep rich purple on exposure, anthers yellow, filaments slightly purplish tinged above and greenish below, stigma light green, about–10-parted, style white or very slightly tinged; fruit purplish red.

This is a conspicuous species throughout the delta region of the Rio Grande. It is especially conspicuous when in bloom. It occurs mostly just above the salt flats where it grows with the mesquite, *Opuntia gommei,* and *O. alta.* The large, deep, purple flowers and large, more or less wavy, blue-green joints are characteristically conspicuous and serve to distinguish the species. The shape and character of joint, however, vary tremendously with the conditions of vigor of the plant. Under cultivation they are much larger and more wavy and the margin more likely to be irregular. The flowers are difficult to describe. Like so many species of this genus a statement regarding the color is of little value unless the changes which occur in it after exposure are depicted. At first when opening the color is almost brick red with a tinge of orange but deeper colored within. Upon exposure to the sun the purple color develops very rapidly and in an hour the flower is a decided purple. Like all other species the opening of the flowers occurs very regularly at a definite time of day.

The description is drawn in the main from a cultivated specimen in the third season's growth, supplemented by notes upon native plants in the type locality. This description was drawn on the 20th of May, 1911, at Brownsville, Texas, when the plants were blooming for the second time that season. They had produced one crop of flowers and joints and another one-half crop was in bloom from matured current year's growth. This so far as observed does not occur in the

native state. The plants at the time the description was drawn, about the middle of the third season's growth, were four feet high, and had a total spread of eight feet and were hemispherical in outline. The type specimen consists of four sheets, bearing my collection number 9702, two prepared in the type locality, Loma Alta, Texas, May 13, 1909, and the other two consisting of a younger joint and flowers, prepared from a cultivated specimen grown from the type and prepared at Brownsville, Texas, May 18, 1911.—Plates 9, below, and 10.

Opuntia undulata, sp. nov.

Plant tall, large, stout, open branching, with cylindrical trunk, often 30 cm. or more in diameter; joints very large, obovate, broadly rounded above, widest above middle, commonly 35 × 55 cm., firm, hard, quite fibrous, dished, wavy or flat, glossy light yellowish green at first, but changing through a darker green with a slight touch of glaucous to scurfy brown on old trunks; leaves subcircular in section, subulate, pointed, usually tinged with red at the tip, about 4 mm. long, upon a prominent tubercle and subtending a prominent dark brown areole; areoles subcircular to ellipsoid or obovate, about 3.5 × 4.5 mm., gray, 5–6 cm. apart; spicules yellow in a short compact tuft in upper part of areole, about 1 mm. long, soon becoming dirty and inconspicuous; spines white, few, short, erect, flattened, straight or twisted, 10 to 15 mm. long, 1 to 3 or 4, mostly one or none; fruit large, 4–5 × 9–10 cm., dull red to slightly tinged with orange and pulp streaked with red and orange when rind is removed.

The species is very distinct in general appearance from any other known to me. It should be placed with the large "mansa" spiny forms grown and cultivated all over Mexico rather than with the *ficus-indica* group, although its spines are very few in number. Indeed it is nearly spineless, but not quite so much so as some of the *O. ficus-indica* group.

The peculiarities of the joints, lacking the usual flat surface until old, the few spines, hard, firm, fibrous texture, and large size are its distinguishing characteristics.

The species was secured in cultivation at Aguas Calientes, Mexico, in August, 1905, under my collection number 8101, and has been in cultivation since at three places. Seedlings have also been grown since that time to plants six feet high,

but neither seedlings nor vegetatively propagated plants have borne fruit in this country. In no case have any of the plants even flowered. The type specimen is one prepared from a cultivated plant at Brownsville, Texas, October, 1910, and bearing my collection number 8101.—Plates 11, below, and 12.

Opuntia perrita, sp. nov.

A low, caespitose, erect to ascending plant, about 20 to 30 cm. high and forming bunches 20 to 100 or more cm. in diameter; joints 15 to 20 cm. long and 2.5 to 3 cm. in diameter, cylindrical or often more or less fusiform or clavate, tubercles prominent, with long slope downward and top of crest close to the areole or upper short slope, comparatively narrow, about 3 cm. long, 12 mm. wide and 1 cm. high, having a darker green line almost completely surrounding it; areoles oval, about 4 × 8 mm. in central portion of joint but smaller above and below, often becoming confluent at apex, gray or tawny, flat, but may be slightly elevated on old joints; spicules light bright brown fading to a dirty yellowish brown on old stems, more prominent below, 1 to 2 mm. long but mostly scarcely visible above; spines long, conspicuous and formidable, light straw colored with loose sheath and spines about same color, 4 to 8, divergent, spreading in all directions, with lower ones more turned back than the others as well as smaller and often only half-sheathed, often 5 cm. long, flattened, including sheath fully 2 mm. in diameter; flowers greenish yellow; fruits yellowish when mature, oval to obovate slightly narrowed above, 3.5 cm. long, bearing a single long straw-colored fugacious delicate spine in upper areoles, about 2½ cm. long, sheathed at tip only, tubercled like the stem.

The species is closely related to *Opuntia tunicata* but is distinguished by its more slender, less spiny stems, and yellow instead of glistening silvery white spines. Like that species, it produces, at times and under certain conditions, a multitude of reproductive joints which are comparatively spineless, or at least do not have any of the long sheathed spines, and are even more easily separable than the terminal spiny ones. It is by these latter that the plant is mainly propagated. Young plants produce smaller and less spiny joints, as a rule, and the spreading is continued by the repeated breaking off of subglobular joints as large as marbles. The two species are found, commonly, growing together, or in more or less sep-

arated areas upon the highland of Mexico, especially in the vicinity of San Luis Potosi, Mexico, where I have studied them at various times for the past six years. In cultivation in Texas, it has been exceedingly difficult to propagate *Opuntia tunicata,* but this one grows readily. Neither has yet flowered under cultivation in Texas.

The description is a compilation of four sets of notes, three taken in the type locality and one from cultivated plants, four of which from two importations are now growing. The type specimen is number 9719 D. G., collected near San Luis Potosi, Mexico, August 10, 1904. The name is one commonly applied to both species in this region, and arises from the fancied resemblance of these plants to small dogs, in attacking the feet of pedestrians.—Plates 13 and 14.

Opuntia tardospina, sp. nov.

A robust, rapid-growing, spreading to half-prostrate species, about one meter or less in height; joints subcircular to broadly ovate or even obovate, often 24 × 30 cm., but usually smaller although in about same proportion, glaucous when young but brighter more yellowish green later, this year's growth about 1 cm. thick and not increasing much in age; areoles very prominent, obovate to subcircular, about 4 × 5 mm. when young enlarging with age to about 1 cm. in diameter and elevated 3 or 4 mm. by protrusion of the abundant wool, brown at first but soon turning black or dirty gray, 3 or 4 cm. apart; spicules light brown proximally and yellow distally and remaining this way or fading to yellow throughout, scattered but more numerous above, unequal, often 12 to 15 mm. long, increasing with age, very stout and formidable, diverging in all directions from the hemispherical areole; spines mostly on old wood, only an occasional one 2 to 3 cm. long in an occasional areole on current year's growth, yellow or brown at base only, very faintly if at all annular, not twisted, mostly tightly recurved or simply sloping downward; fruit broadly obovate to pyriform, about 4 × 5.5 cm., having small subcircular black areoles bearing a small tuft of spicules like the stem, about 15 mm. apart.

The species is very different from any known to me. The spicules are very long, numerous and prominent, sometimes covering the old stems, much like those of *Opuntia chlorotica santarita.* Sometimes the spines become 2 to 4 cm. long, but this is rare. This applies to the plant growing in its natural habitat. When under the more favorable conditions of culti-

vation, the spines are much more numerous than indicated in the description, which was drawn from the type plant. They are, however, tardy in their development, appearing mostly the second year. By the third year, the plant is really very spiny under cultivation.

As stated, the description is mainly from the type plant, but notes have been kept for three years on the species under cultivation.

The type specimen is number 9338 D. G., collected near Lampasas, Texas, July 3, 1908, together with some put up later from material grown from cuttings of the type plants. It inhabits the valley lands and is one of the largest species of the region. Under cultivation at San Antonio, Texas, it has bloomed very sparsely the second year, from single joint cuttings.—Plates 11, above, and 15.

Opuntia gilvoalba, sp. nov.

A low erect to ascending species, about 1 m. high and 1 to 2 m. in diameter, with branches frequently on edge on ground and others erect from them, hemispherical in outline when fully developed; joints obovate, broadly to sharply pointed above and contracted and almost stipitate below, yellowish green, about 18×20 cm., thin; areoles large, prominent, brown, turning to dirty gray, and finally black, obovate becoming subcircular, 8–10 mm. in diameter, and about 5 cm. apart; spicules prominent, scattered, unequal, about 1 cm. long, diverging in all directions; spines yellow, stout, annular, diverging in all directions but mostly sloping downward, flattened, seldom twisted, 2 to 2.5 cm. long, increasing somewhat both in length and numbers. 2 to 6 mostly about 4; flowers yellowish white, large and showy, about 10 cm. in diameter when fully opened, petals narrowly obovate with a prominent cuspidate point, style and filaments white, stigma light green; fruit purplish-red, obovate-pyriform, about 34×60 mm., raised at areoles when young, but this disappearing when fully mature, bearing small subcircular areoles with a tuft of divergent spicules the largest of which may be 1 cm. long, these dropping off early, leaving the areole dirty gray.

The species inhabits the brushy, low elevations in the salt marshes of the delta of the Rio Grande. It is readily recognized by its joint and flower characters. The color of the flowers is a very light yellow, almost white, with possibly a tinge of green. It almost exactly matches that of *Opuntia*

leptocaulis. It has grown with us in cultivation at San Antonio, Texas, since March, 1908. The winter of 1910-11 was rather severe, and as a consequence much of each plant was killed. They, however, bloomed profusely in 1911. It blossomed the second year from single joint cuttings.

The type was collected at La Tule, Texas, March 5, 1908. The type specimen is a sheet consisting of a joint and flower number 9046, put up May 4, 1910, at San Antonio, Texas, from a cultivated plant grown from a cutting of the original collection bearing the same number. The description is a compilation of several sets of notes taken mainly from cultivated plants.—Plates 9, above, 16 and 17.

EXPLANATION OF PLATES.

Plates 1, 2.—*Opuntia Bentonii*, from type plant.

Plate 3.—*Opuntia Gregoriana*, from type plant. Note fallen fruit.

Plates 4, 5.—*Opuntia incarnadilla*, from type plants in cultivation.

Plate 6.—*Opuntia vexans*, from the type in cultivation.

Plate 7.—1, *Opuntia vexans*, two right-hand rows, the first three of the figures representing mature dried fruits. 2, *O. arborescens*, left-hand row, the first of the figures representing a mature dried fruit.

Plate 8.—*Opuntia demissa*, from native type plant.

Plate 9.—1, *Opuntia gilvoalba*, above. 2, *O. cyanella*, below. Both under cultivation.

Plate 10.—*Opuntia cyanella.*

Plate 11.—1, *Opuntia tardospina*, above. 2, *O. undulata*, below. Both under cultivation.

Plate 12.—*Opuntia undulata.*

Plate 13.—*Opuntia perrita*: above, under cultivation; below, spontaneous.

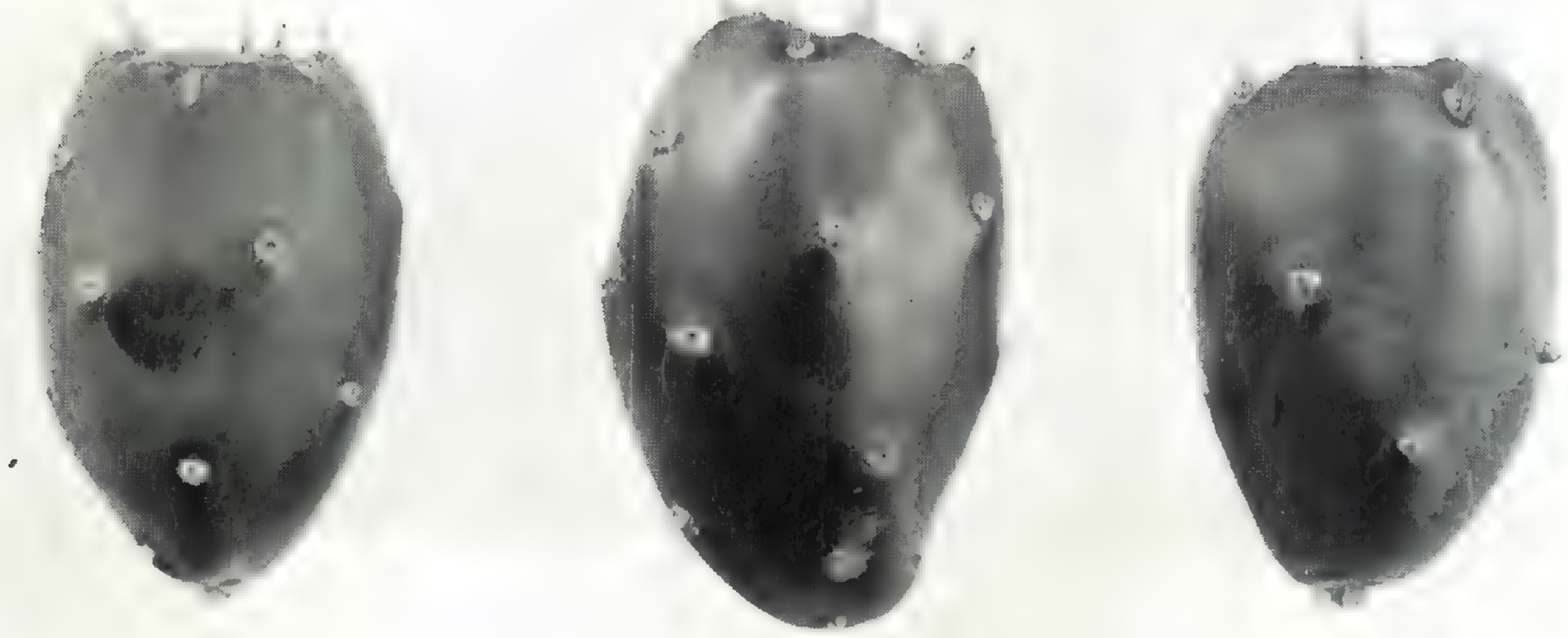
Plate 14.—*Opuntia perrita.*

Plate 15.—*Opuntia tardospina*, from a cultivated plant.

Plates 16, 17.—*Opuntia gilvoalba.*

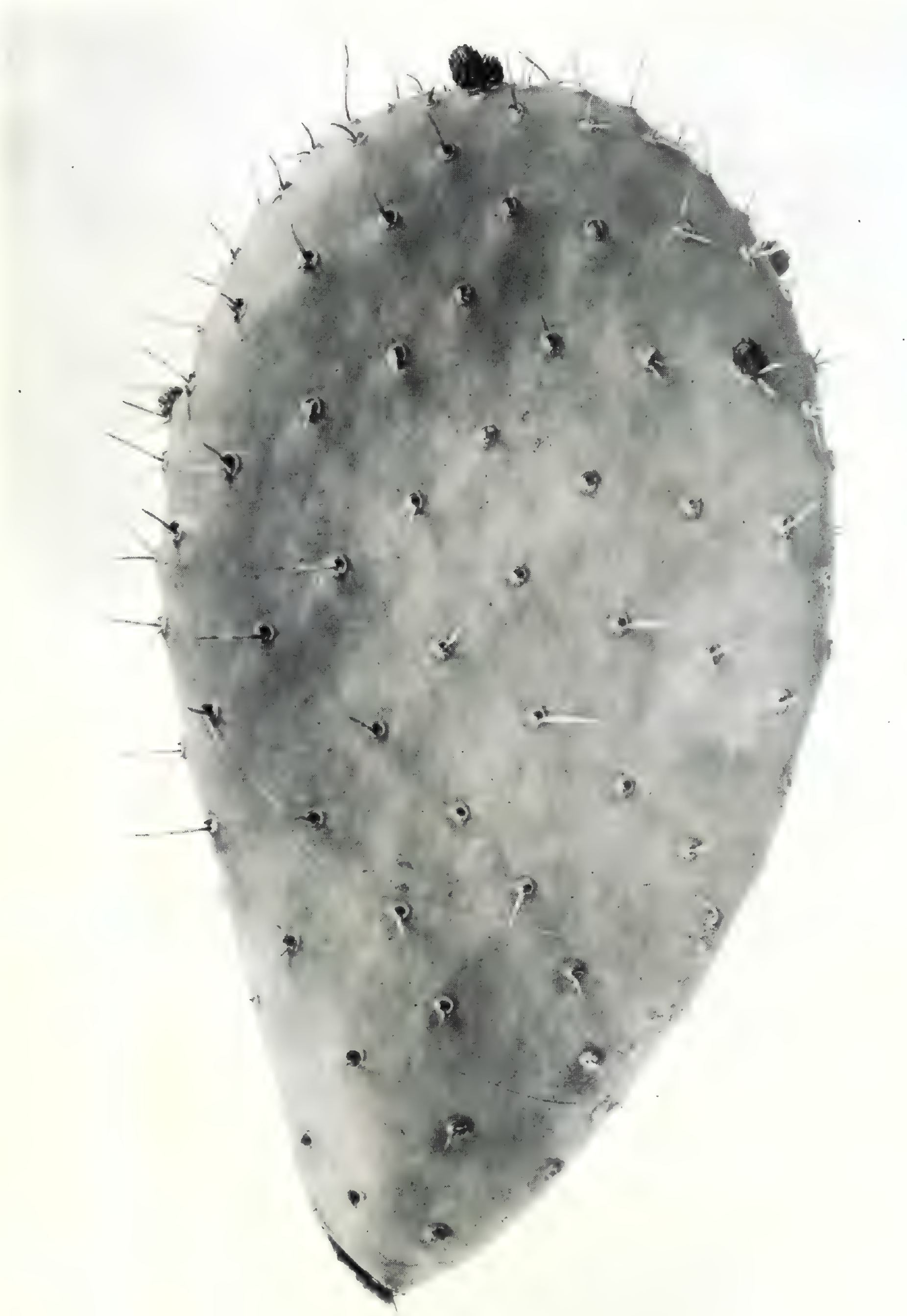
OPUNTIA BENTONII.

OPUNTIA BENTONII.



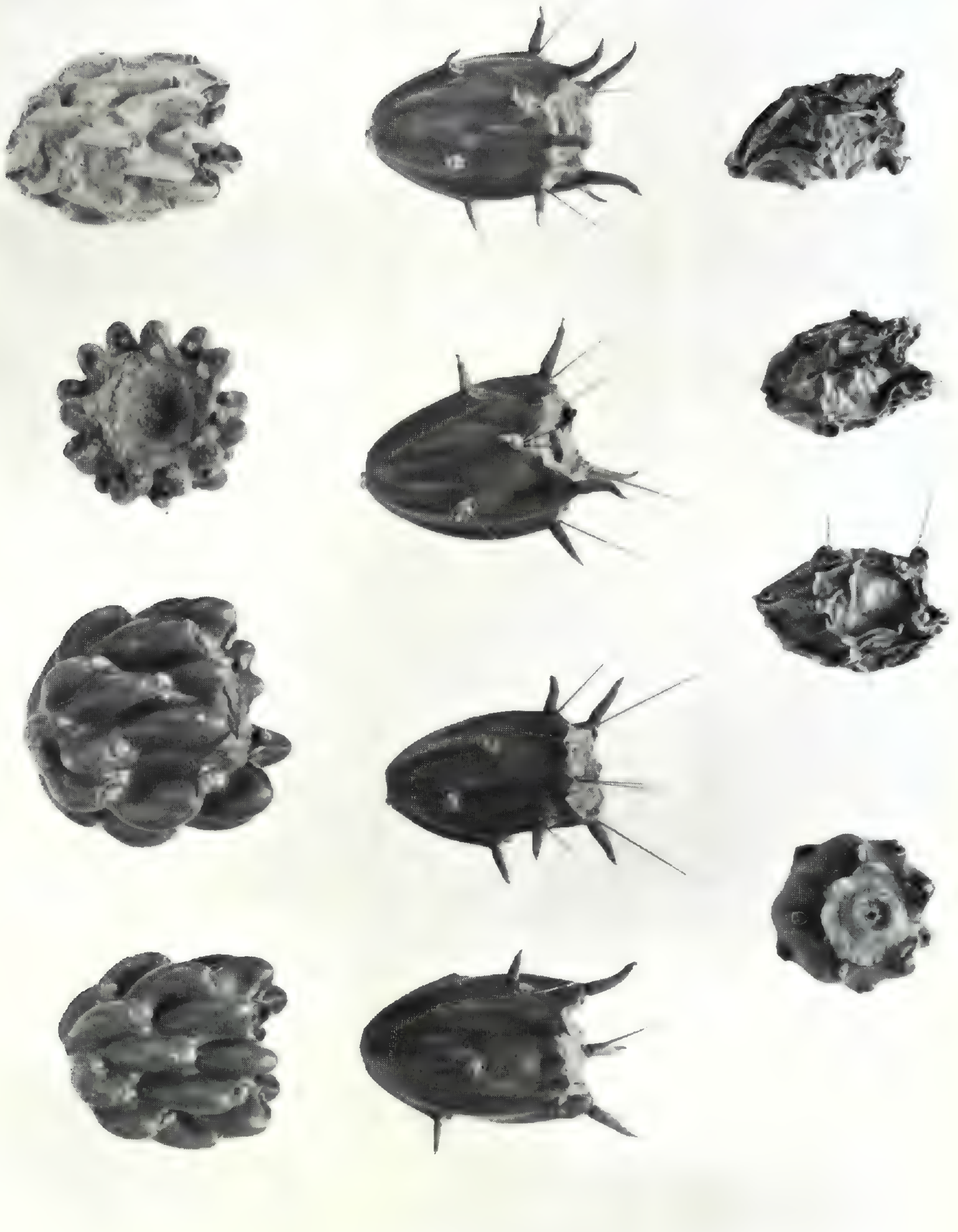
OPUNTIA GREGORIÂNA.

OPUNTIA INCARNADILLA.



OPUNTIA INCARNADILLA.

OPUNTIA VEXANS.



OPUNTIA VEXANS AND O. ARBORESCENS.

OPUNTIA DEMISSA.

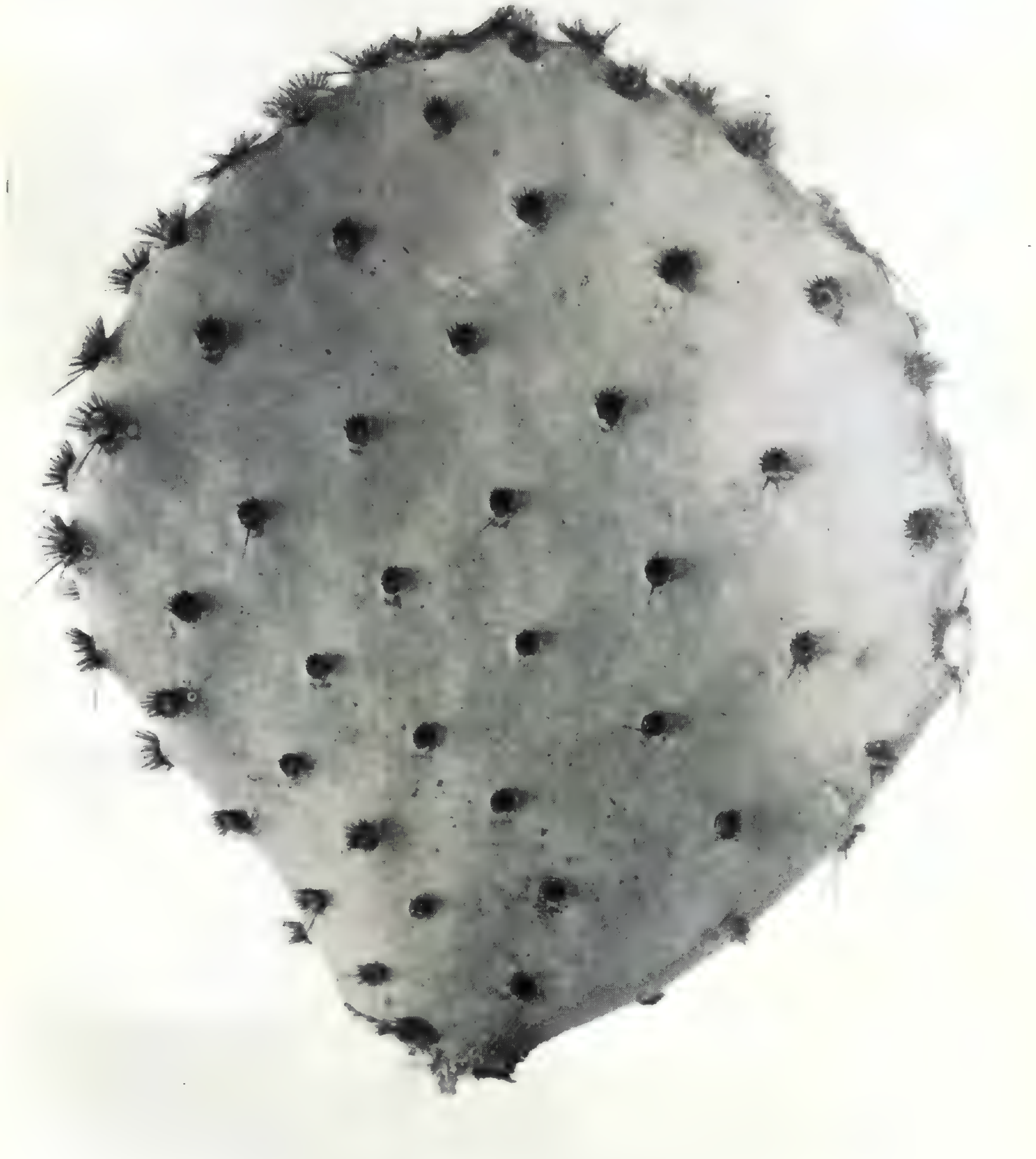
OPUNTIA CYANELLA.

OPUNTIA TARDOSPINA AND O. UNDULATA.

OPUNTIA UNDULATA.

OPUNTIA PERRITA.

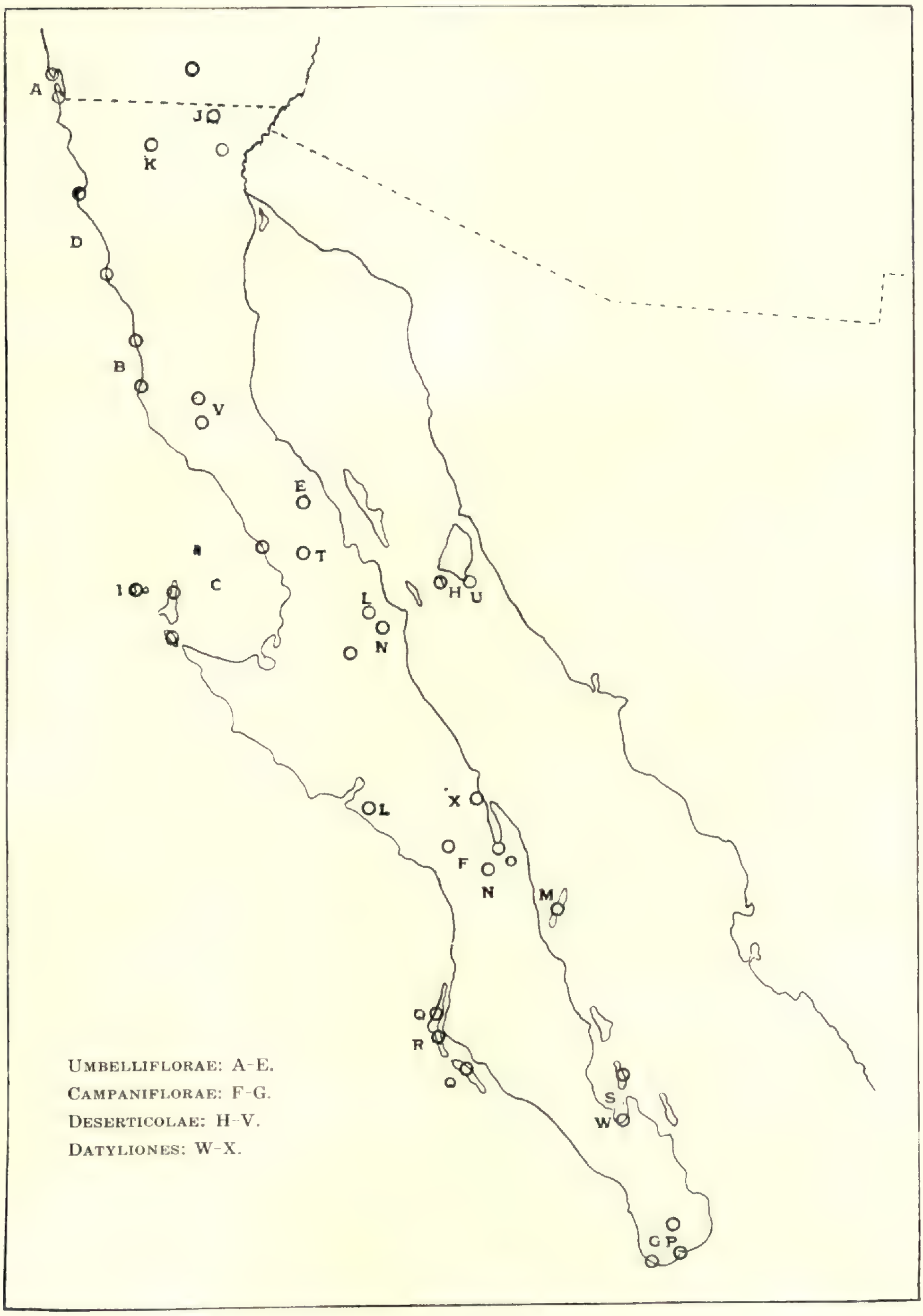
OPUNTIA PERRITA.



OPUNTIA TARDOSPINA.

OPUNTIA GILVOALBA.

OPUNTIA GILVOALBA.



AGAVE IN LOWER CALIFORNIA.

THE AGAVES OF LOWER CALIFORNIA.

BY WILLIAM TRELEASE.

In the spring of 1910, Dr. J. N. Rose, of the United States National Museum, sent me for determination eight specimens of *Agave* brought back from Lower California in 1905 by Messrs. E. W. Nelson and E. A. Goldman, of the Bureau of Biological Survey of the United States Department of Agriculture, on their return from a venturesome and trying reconnaissance of the peninsula, of which Mr. Nelson has recently published an interesting illustrated account.[1] Other tasks prevented me from more than casually examining this material until midsummer of 1911, when it was subjected to critical study, including a careful examination of the general literature of *Agave* and of specimens representing the groups to which the Lower Californian species belong or with which they might be compared. On the completion of this study I was further obliged by Dr. Rose with fourteen specimens which he himself had collected in the early part of 1911, under the auspices of the United States National Museum and the New York Botanical Garden, at landings effected during a cruise of the U. S. Steamer "Albatross" about the peninsula. An additional specimen collected by him in 1897, and twelve other sheets from the National Herbarium, were also placed in my hands subsequently, by Dr. Rose. The conclusions as to earlier-published species have been confirmed or corrected and the descriptions brought into camparability with those now first published, through the courtesy of Professor H. M. Hall and Mr. T. S. Brandegee, of the University of California—the latter of whom made extensive Lower Californian collections in 1889, 1890 and 1892, on which he has published,[2] who have obligingly sent me for examination twenty-two peninsular specimens including the types

[1] National Geographic Magazine. **22**: 443. May 1911.

[2] Proc. California Academy of Sciences. ii. **2**: 117, Nov. 12, 1889; and ii. **3**: 108, July 14, 1891 and 218, Nov. 10, 1892.

of all of Mr. Brandegee's species. No small profit has been derived further from study of small plants collected this year by Dr. Rose, as part of his very large gathering of living succulents, and for which I am equally indebted to the officers of the National Museum and of the New York Botanical Garden. The study of all of this material has proved unusually interesting, and my sincere thanks are recorded for the privilege of making it, as well as for access to and use of the very full field notes and the photographs that accompany many of the specimens. Dr. Rose has also done me the favor of revising the manuscript, with the specimens in hand.

Lower California is essentially a desert, but it is relieved by a broken chain of mountains reaching an altitude of over ten thousand feet on part of which rainfall is sufficiently abundant and the prevalent high temperature sufficiently mitigated to permit forest development. The southern cape region is said to be blessed with summer showers, rarely experienced above. Mr. Brandegee has indicated a change in the character of the vegetation to the north and south of the divide between Calmalli and Cardon Grande, that of the north being more and that of the south less like the Californian flora. Mr. Watson long since called attention to the fact that the flora of the peninsula is Mexican rather than Californian in its general characters.

Agave is essentially a desert genus of plants, centering on the dry tableland of Mexico and rarely dropping into the rainy piedmont. Nevertheless, in some of its forms it occurs through the entire chain of West Indian islands, which are essentially arid in a part of their coast region at least, and its outlying representatives are found as far south as the upper Andean region, and as far north as Utah, in the United States, while its eastern and western limits are the oceans.

I have no knowledge of an agave native to an oceanic island, and water seems always to offer an effectual barrier to distribution in this genus. Even on the mainland, no species is known to have a range of very large extent with exception of the common lechuguilla, which, in fact, is rep-

resented by a series of closely allied succeeding forms in the extensive region over 100 miles wide and 700 miles long that it inhabits between western Texas in the United States and San Luis Potosi in Mexico. It is not surprising, therefore, that in arid Lower California the genus should be well represented and that the number of species thus far collected should nearly equal the number of localities from which collections have been made, nor that none should be known to occur in more than a rather narrowly limited region. There is no more reason for surprise in the fact that all which are yet known should be endemic, for the lower third of the Gulf, separating the peninsula from continental Mexico, is over 1,000 fathoms deep, pointing to a very long isolation, and 100-fathom depths continue through the remainder, almost to its head, so that connection with the mainland to the east appears to have been restricted for a very long time to at most a small extension of the desert land flanking the mouth of the Colorado River. The coastwise islands all stand well up on the 100-fathom shelf and some of them are parted from the peninsula by very shoal water. The indications, therefore, are that the Lower Californian agaves have entered from the north and not by crossing the Gulf and that those of the adjacent islands have been derived from the peninsula; and the general effectiveness of water barriers in the spread of the genus is such as to make it probable that the species found on the islands reached them at a period when they were joined to the adjacent land.

All of the known Lower Californian agaves belong to the paniculate subgenus Euagave. To the eye they fall into four groups: a compact, broad-leaved, large-toothed form, represented by *A. Shawii,* confined to the northern half of the peninsula and, with one exception, to its western coast; a more open typically narrow-leaved, often fragile-toothed form, comparable with *A. deserti* of the Colorado Desert, of wide occurrence and less uniform appearance than the preceding; a form with large recurving lanceolate leaves, moderately armed, occurring below the middle of the peninsula,

typically represented by *A. aurea;* and a form with dagger-like, heavy-prickled leaves, also confined to the lower half of the peninsula, of which *A. Datylio* is representative. These groups are fairly consistent in flowers and fruit except that a number of plants that resemble *A. Shawii* somewhat in growth prove on these characters to be more closely related to the very different looking *A. deserti,* around which cluster the largest number of forms. In the synopsis which follows, these groups have been made the basis of classification.

So far as is now known, these groups, like their component species, are essentially endemic. The first, Umbelliflorae, is most closely allied to the boreal set of species of which *A Parryi* is a well-known representative. The second, Deserticolae, centers about *A. deserti,* which in its typical form occurs in the desert shortly north of the boundary; but the occurrence of two species, not placeable elsewhere, on islands that clearly belong to the mainland and not the peninsula, gives reason to suppose that this group may be found to have mainland representatives not yet made known. The third, Campaniflorae, though notably different, can be compared with nothing as closely as with *A. Palmeri* of the Arizona region, which possesses an undescribed equivalent in Durango. The fourth, Datyliones, is of the stock to which the Sisalanae of Yucatan and the Tequilanae of southern and western Mexico belong, and apparently more closely related to the former. The first three groups, which comprise nearly all of the species known for Lower California, thus give indication in their relationships of the probability, pointed by geographic considerations, of their entry around rather than across the Gulf; but this conclusion is not evident in case of the Datyliones, and much less evident for the Campaniflorae than for the first two groups.

It is interesting that *Agave,* like *Nolina, Yucca, Fouquieria,* etc., seems to have passed into Lower California from the northeast without entering California except in its southernmost desert part, while close allies of the first (*Manfreda,* widely distributed through Mexico and sparingly represented

in the United States east of the divide) and of the second (*Dasylirion,* characteristic of the backbone of the continent as far north as Texas and Arizona) have failed to pass the desert; the wide-spread genus *Yucca,* which has followed *Agave* in its penetration of the peninsula, though absent from California, is represented in the flora of that state by two local monotypic genera; and *Fouquieria* is accompanied in Lower California by its odd derivative, *Idria.*

The first definitely known *Agave* of Lower California—or Baja California, as it is called in Spanish—was described by Engelmann in 1875, under the name *A. Shawii.* In 1885 a related species, *A. sebastiana,* was made known by Greene. In 1888 Baker published the description of a third, *A. Pringlei,* which had been distributed in Pringle's exsiccatae of 1882 under this manuscript name, given it by Engelmann, who, however, failed to satisfy himself subsequently that it was distinct from *A. deserti* of the Colorado Desert, which he had previously characterized. Without description, Mr. Baker also published in 1888 the name *A. scaberrima* as applied to a plant in the Peacock collection that had flowered in 1881 and may have been the similarly named plant listed by Verschaffelt as early as 1869; no indication of its origin is given, but it is mentioned under *A. Pringlei* as allied. It can scarcely have been from Lower California, and remains unknown since *A. asperrima,* which has been given this name by error, could hardly have been compared with a species related to *A. deserti.* In 1889 Mr. Brandegee doubled the number of species accredited to Lower California by publishing *A. aurea, A. margaritae* and *A. sobria.* To his introduction of living plants is also attributable mention of the name *A. spiralis* in 1900, though this is yet uncharacterized. In this same year *A. Datylio* was listed, but it was not until 1902 that Dr. Weber described it.

The present study increases the number of species to twenty-two. Considering the sometimes misleading habit resemblances of some of them, it is probable that others will be found to have been passed by in the territory already explored. The small part of the peninsula covered by them

as they are now known in the herbarium at once points to the probability of other equally interesting discoveries and indicates the need of definite outlining of the extremely limited ranges of most of those now recognized.

In his exploration of the San Benito islands Dr. Palmer noticed on West San Benito two representatives of this genus, but he collected neither; his observation was recorded by Vasey and Rose (Contr. U. S. Nat. Herb. **1**: 20. 1890) in their account of the plants of those islands. Though there is no improbability of more than one species of the set of *A. Shawii* being found on the rather isolated islands and the mainland about Sebastian Viscaino Bay—as actually appears to be the case on the scarcely detached islands about Magdalena Bay, Dr. Rose though he had the occurrence of a second species in mind when he visited San Benito last spring did not then note its presence and I am unable to see anything except *A. sebastiana* in the herbarium material from that region. Among the living plants brought back by Dr. Rose, however, are small plants from San Benito, bearing the field number *41,* which are very different from the herbarium material of the corresponding number, *16041,* representing *A. sebastiana.* No doubt these living plants are of the second species noted by Dr. Palmer, which, though aberrant, is obviously of the Deserticolae, and for completeness is now given name and place, though its described characters unfortunately are comparable with those of a large majority of garden agaves and probably far from representative of mature plants.

One curious distributional fact is that the Campaniflorae and Datyliones are each represented by slightly differentiated species, peculiar respectively to the Cape region and the mid-peninsula.

All of the Lower Californian agaves referred to in such publications as I have seen are accounted for in the following pages, except *A. spiralis,* which Mr. Brandegee tells me was found wild about La Paz and in his garden at San Diego responded to the care given it by developing into a truly arborescent plant about 3 m. high which suckered freely so

as to form a massed growth, but never flowered. Subsequent search about La Paz by himself and others has failed to result in the rediscovery of anything comparable with this cultivated specimen or recognizable as *A. spiralis,* which really appears to be scarcely distinguishable from *A. decipiens* of Florida and the status of which on the western side of the continent must await further study.

As on the Mexican mainland, mezcal is made from some of the species. Mr. Brandegee records that *A. aurea* is put to this use, while he was led to name another species of the same region *A. sobria* because it was said not to be so used. No doubt fiber is extracted locally for domestic purposes from a number of the species. In connection with his collection of the long-leaved plant which I have named *promontorii,* Dr. Rose notes that it is probably used for fiber because he found that the young cores had been cut out frequently. It is possible that the references to *A. aurea* as a fiber plant really pertain to this, its Cape representative; in any event it appears from the published statements that efforts have been made to cultivate for fiber what was taken for *A. aurea.* In 1897 Dr. Rose made a collection of the true henequen, *A. fourcroydes,* in a yard at La Paz, but I lack information that it has been grown on a large scale in the peninsula. When, in 1902, Dr. Weber (Bull. Mus. Hist. Nat. **8**: 218-224) published the brief account of the agaves of western Mexico and Lower California in which he named the principal species grown for the commercial production of mezcal about Tequila *A. tequilana,* he illustrated its flowering aspect by a photograph made by M. Diguet in Lower California, where it was said to be cultivated frequently. A little above a year since, while studying the numerous and diverse mezcal species of western Mexico, I learned from Consul Lucien Sullivan of La Paz, through the kindly offices of our national Secretaries of State and Commerce and Labor, that a plantation of about 100,000 plants, occupying some 75 acres of ground, exists at San Antonio, about fifty miles southeast of La Paz, from which between 18,000 and 20,000 liters of mezcal are made annually. Specimens of the plant

cultivated at San Antonio, which Mr. Sullivan secured through the interest of the Chief of the Revenue Stamp Office at La Paz, Sr. Talamantes, show that it is not an indigenous species, but one introduced from the mainland, though it proves not to be the "mezcal azul," *A. tequilana,* as supposed when it was used in illustration of that species, but it appears to be the "cuchara" form, which differs in a number of characteristic respects from *A. tequilana,* though as yet unnamed botanically. Mr. Sullivan further states that the fiber of this cultivated mezcal is extracted to a limited extent and that efforts are being made to increase this use of the plant.

SYNOPSIS.

Shortly caulescent but leafy throughout in a globose or ellipsoid head. Leaves hard-fleshy, stiff and straight, typically short and broad: spine stout, openly grooved, decurrent: prickles large, often confluent. Scape very stout, covered by deltoid appressed bracts. Panicle short with stiff nearly horizontal almost simple branches bearing large funnel-shaped flowers in dense almost head-like clusters. Filaments inserted within the tube. UMBELLIFLORAE.

Flowers almost sessile in dense bracted clusters: filaments inserted about the middle of the tube. Capsules with very thick exocarp surrounding a core. *A. Shawii.*

Flowers short-pedicelled on longer secondary branches of the panicle: filaments inserted about the upper fourth of the tube. Capsules woody.

Spines sinuous and rather slender. *A. Orcuttiana.*

Spines nearly straight, elongated or very stout if short.

Prickles gradually tapering from the base. *A. sebastiana.*

Prickles much widened at base.

Capsules oblong: seeds large. *A. pachyacantha.*

Capsules pyriform: seeds moderate. *A. Goldmaniana.*

Acaulescent. Leaves fleshy, elongated and outcurved: spine stout, narrowly grooved, shortly decurrent: prickles rather large, on fleshy prominences. Scape stout, with triangular recurving bracts. Panicle ample, decompound, with medium-sized golden bell-shaped flowers. Filaments deep-seated. CAMPANIFLORAE.

Perianth-tube half as long as the segments. *A. aurea.*

Perianth-tube rather deep, two-thirds as long as the segments. *A. promontorii.*

Acaulescent. Leaves fibrous-fleshy, stiff, straight or falcate, typically narrow: spine typically slender and narrowly grooved, decurrent: prickles usually moderately large, sometimes friable. Scape slender, with triangular suberect bracts. Panicle short with rather

simple slender ascending branches and medium-sized or small yellow cup-shaped flowers, usually very short-tubed. Filaments inserted nearly in the throat. DESERTICOLAE.

Leaves triangular or narrowly lance-oblong.

Prickles close-set, minute.

Friable, almost without cusps. *A. dentiens.*

Firmer, with sharp but short cusps. *A. disjuncta.*

Prickles moderately distant and developed.

Spine nearly straight. Perianth segments about 15 mm.

Leaves moderately wide with fairly strong spine.

Margin rather repand: prickles gradually tapered.

Ovary flask-shaped, short. *A. deserti.*

Ovary fusiform, elongated. *A. consociata.*

Margin nearly straight: prickles lenticular at base.

Ovary fusiform, exceeding the perianth. *A. Pringlei.*

Leaves narrow with very slender spine: margin mostly repand.

Pedicels racemose. Leaves rough. *A. cerulata.*

Pedicels capitate. Leaves smooth. *A. carminis.*

Spine? Perianth segments fully 20 mm. long. Leaves smooth. *A. sobria.*

Spine tortuous. Leaves rough. *A. affinis.*

Leaves broadly lanceolate or oblanceolate with rather close-set short firm dark prickles. *A. Brandegeei.*

Leaves broadly lanceolate or oblanceolate with rather distant large firm prickles.

Prickles moderately wide, little dilated at base.

Spine at first chestnut, nearly straight. Prickles relatively short. *A. margaritae.*

Spine from dull red becoming ashen. Prickles long, often curved like fish-hooks. *A. connochaetodon.*

Prickles very wide, often much dilated below.

Spine tortuous: margin often deeply repand. Perianth segments short. *A. Roseana.*

Spine nearly straight: margin scarcely repand. Perianth segments long. *A. avellanidens.*

Leaves oblong to ovate-oblong. Spine conical, straight, round-grooved.

Prickles long and firm. *A. subsimplex.*

Prickles short and friable. *A. Nelsoni.*

Acaulescent. Leaves fibrous-fleshy, stiff, straight, dagger-shaped: spine strong, grooved below, scarcely decurrent: prickles heavily triangular. Scape slender. Panicle narrowly oblong, with greenish tubular flowers. Filaments deep-seated. DATYLIONES.

Spine grooved at base only. Filaments long. *A. Datylio.*

Spine grooved toward the middle. Filaments short. *A. vexans.*

AGAVE SHAWII Engelmann, Trans. Acad. St. Louis. **3**: 314, 370. *pl. 2–3*, 579. *pl. 4*, 1875; Bot. Works. 311, 315. *ff.*— Gartenflora. **25**: 155; **26**: 164. *pl. 905*.— Belg. Hort. **1887**: 93.— Hamburg. Gart. Zeit. **1877**: 376.— Baker, Gard. Chron. n. s. **7**: 717; Handbook Amaryllid. 172; Kew Bull. **1892**: 3 and Add. Ser. **2**: 219.— Peacock, List. 2.— Orcutt, West Amer. Scientist. **4**: 68; **7**: 96.— Palmer, Amer. Journ. Pharm. **50**: 588.— Terracciano, Primo Contributo. 49.— Ricasoli, Utilita dei Giardini d'Aclimazione. 9.—Nicholson, Dict. **1**: 41; Dict. Prat. **1**: 86.—[Handbook] Mo. Bot. Gard. **1893.** *frontispiece*.— Kew Hand List Tend. Monocot. 121.—Rose in Bailey, Cyclop. **1**: 34.—Cactus Journ. **2**: 181. *f.*—Segura, El Maguey. 4 ed. 71.—Müller, Bot. Zeit. Abt. I. **67**: 94, 113, 135.

Agave sp. Harwood, New Cr. in Plant life. 163. *f.*

A. Schawii Simon, Cat. [**1900**]: 16.

A. Shawi Menand, Cat. Pl. Albany. 20.— L. DeSmet, Cat. 10: 35; 11: 9.— DeSmet Frères, Cat. 25: 9.— Gardening Ill. **15**: 21.

Cespitose, shortly caulescent (scarcely 1 m.), leafy throughout. Leaves smooth, green, rather glossy, ovate or lance-ovate, acuminate, openly concave, 6–12 × 20–50 cm., stiffly erect-spreading: spine acicular, flexuous, decidedly reddish, 3–6 × 20–40 mm., very openly grooved almost to the end, long-decurrent: prickles at first glossy garnet, 10–25 mm. apart, very large, often 10–15 mm. long, variously curved or even hooked and following the leaf convexity, elongated-triangular, somewhat abruptly widened to about 10 mm. at base, the intervening often continuously horny margin rather repand. Inflorescence about 3 m. high, the upper third or less ovoid-paniculate: scape stout: bracts deltoid, subimbricated, appressed: branches not very numerous, stout, moderately long, nearly horizontal, subsimple or very shortly tripartite with almost capitate bracted clusters: pedicels very short, much thickened in fruit. Flowers greenish yellow, slightly fetid, 70–90 mm. long: ovary 30–40 mm. long, subfusiform: tube openly conical, 15–20 mm. deep: segments attenuate from a wide base, about 8 × 20 mm., more or less equaling the tube and half as long as the ovary: filaments inserted about the middle of the tube, 55–60 mm. long and nearly thrice as long as the segments. Capsules oblong, 20–25 × 50–70 mm., strongly beaked but scarcely stipitate, with unusually thick exocarp surrounding a papery core: seeds 7 × 8–9 mm.

Coast of extreme southwestern California and adjacent Lower California.—*Shawii*,—Henry Shaw, founder of the

Missouri Botanical Garden, in whose establishment the species first flowered in cultivation.—*Map* (A). *Pl. 19-21.*

Specimens examined: South of San Diego, at the Initial Boundary Monument (*Hitchcock,* 1875,—the type; *Palmer,* 1875; *Parry*).

Agave Orcuttiana Trelease.

A. Shawii Brandegee, Proc. Cal. Acad. ii. **2**: 207. 1889.

Aspect of *A. Shawii*, but the more or less reclinate leafy trunk as much as 3 m. long. Leaves smooth, rather green, lance-elliptical, somewhat acuminate, 6–10 × 15–30 cm.: spine acicular, flexuous, dull gray, 4 × 20–25 mm., openly grooved to beyond the middle, long-decurrent: prickles similarly colored, about 10 mm. apart, usually large, sometimes 15 mm. long, variously curved or hooked, narrowly triangular, obliquely lunately widened into the nearly straight margin. Inflorescence paniculate: pedicels about 5 mm. long. Flowers about 75 mm. long: ovary 35–40 mm. long, subfusiform: tube conical, 12–15 mm. deep: segments attenuate from a wide base, about 7 × 20 mm., one-third longer than the tube and half as long as the ovary: filaments inserted about the upper third of the tube, about 50 mm. long and more than twice as long as the segments. Capsules?: seeds 6 × 8 mm.

Coast of northwestern Lower California.—*Orcuttiana,*—C. R. Orcutt, an earnest collector and student of the plants of California and Lower California.—*Map* (B). *Pl. 22.*

Specimens examined:—San Quintin (*Orcutt,* April 14, 1886,—the type). Rosario (*Orcutt,* Feb., 1883,—a leaf with small, close-set prickles).

AGAVE SEBASTIANA Greene, Bull. Cal. Acad. **1**: 214. 1885: Pittonia **1**: 198, 208.

? *A. applanata Parryi* Purpus, Monatsschr. Kakteenkunde. **9**: 36; Cactus Journ. **2**: 39.

Habit of *A. Shawii.* Leaves smooth, glaucous, ovate to lanceolate, not very acuminate, openly concave, 6–10 × 15–30 cm., stiffly erect-spreading: spine variously conical, nearly straight, graying or darkening from rather dull red-brown, 5 × 20 to 30 or as much as 50 mm., openly grooved to beyond the middle, long-decurrent: prickles similarly colored, at first glossy, usually 10–15 or 20 mm. apart, 3–5 or even 10–15 mm. long, usually rather straight, retrorse below, narrowly triangular, their more or less lunate or lenticular bases connected by the straight or deeply notched horny margin. Inflorescence about 2 m. high, sometimes almost corymbose: scape stout: bracts not imbri-

cated, suberect: branches rather few, stout, ascending, compound: pedicels 5– often 10 or 15 mm. long. Flowers yellow, less densely aggregated than in *A. Shawii*, 60–85 mm. long: ovary 35–50 mm. long, oblong-fusiform: tube very openly conical, 12–17 mm. deep; segments attenuate, about 9 × 20 mm., longer than the tube but little more than half as long as the ovary: filaments inserted about the upper third of the tube, 50 mm. long, more than twice as long as the segments. Capsules with hard thick walls, very large, about 30 × 60–80 mm., beaked but scarcely stipitate: seeds very large and glossy, 7 × 11 mm.

Coast of west-central Lower California.—*Sebastiana*,—from its occurrence about Sebastian Viscaino Bay.—*Map* (C). *Pl. 23-26.*

Specimens examined:—Cedros Island (*Greene*, May 1, 1885,—a co-type; *Brandegee*, Apr. 1, 1897; *Rose, 16122*, Mar. 10, 1911). San Benito Island (*Anthony, 264* ,1897; *Rose, 16041*, Mar. 9, 1911). Sta. Rosalia Bay (*Anthony, 145*, Aug. 16, 1896).

Young plants collected on Cedros Island by Dr. Rose under his field number *122*, and grown at the New York Botanical Garden under the number *34174*, for which, as for living representatives of nearly all of Dr. Rose's agaves of 1911 I am indebted to him and Professor Britton, are decidedly granular-roughened, and rather noticeably lined with darker green over the fibro-vescular bundles which are closely surrounded by chlorenchyma. In variation of outline and marginal arming this and the following differ from the two preceding species, from either of which some leaves are indistinguishable.

Agave pachyacantha Trelease.

Aspect of *A. Shawii*. Leaves smooth, rather gray, elliptical or broadly lanceolate, acuminate, 10–12 × 25–40 or even 75 cm.: spine nearly straight, stoutly conical, chestnut becoming dull or brownish gray, 6–9 × 25–40 mm., very openly grooved, long-decurrent: prickles similarly colored, about 15 mm. apart, large, about 10 mm. long, prevailingly retrorsely curved, heavily triangular, rather abruptly widened into the margin or where this is repand their heavy bases lunately dilated to a width of 10–15 mm. on the tops of the fleshy prominences. Inflorescence paniculate: pedicels about 5 mm. long. Flowers 75–80 mm. long; ovary about 35 mm. long, subfusiform-oblong: tube conical, 15 mm. deep: segments gradually acuminate, 7–8 × 25–30 mm., nearly

twice as long as the tube and approaching the ovary in length: filaments inserted about the upper fourth of the tube, 60–90 mm. long and about three times as long as the segments. Capsules thin-walled, oblong, 20 × 60 mm., long-beaked, but not stipitate: seeds 5–6 × 7–8 mm.

Northwestern Lower California, in the coast region.—*Pachyacantha,*—thick-spined, because of the terminal leaf spine.—*Map* (D). *Pl. 27, 28.*

Specimens examined:—Punta Banda, Todos Santos Bay (*Orcutt,* Jan. 24, 1883,—the type). Cape Colnett (*Brandegee,* May 1893).

Agave Goldmaniana Trelease.

Aspect of *A. Shawii.* Caulescent, the more or less reclinate trunk leafy throughout. Leaves smooth, gray?, lance-ovate or lanceolate, acuminate, openly concave, about 10 × 50 cm., stiffly erect-spreading: spine nearly straight, half conical, dull blackish gray, 7 × 40 mm., very openly grooved almost to the end, long-decurrent: prickles similarly colored, 15–30 mm. apart, often 10 mm. long, rather gently variously curved, heavily triangular, lunately widened into the little-repand margin or confluent. Inflorescence 5–7 m. high, the upper third broadly ovoid-paniculate: scape stout: bracts deltoid, scarcely imbricated, erect; branches rather numerous, nearly horizontal, shortly tripartite: pedicels scarcely 5 mm. long. Flowers deeply funnel-form, as shown by photographs. Capsules narrowly oblong-pyriform, about 20 × 50 mm., beaked and somewhat stipitate, not very thick-walled: seeds glossy, 4 × 6 mm.

Eastern Lower California, in the desert.—*Goldmaniana,*—E. A. Goldman, an experienced student, collector and photographer of the plants and animals of tropical North America. Yubai (*Nelson & Goldman, 7151,* 1905).—*Map* (E.) *Pl. 29-31.*

Entirely out of the region affected by other allies of *A. Shawii,* and in the desert association of *A. Nelsoni,* etc.

AGAVE AUREA Brandegee, Proc. Cal. Acad. ii. **2**: 207. 1889; —Weber, Bull. Mus. Hist. Nat. **8**: 223.

Agave sp. Brandegee, Proc. Cal. Acad. ii. **2**: 119.
? *Agave* Maguey del Campo. Simon, Cat. [1900]: 16.

Not cespitose, acaulescent. Leaves smooth, grayish green, lance-oblong, acuminate, openly concave, becoming 10–15 × 75–100 cm.: outcurved-ascending; spine conical or somewhat awl-shaped, slightly curved, from glossy chestnut sometimes becoming dull gray, 3–5 × 20–30 mm., rather narrowly grooved below the middle, decurrent for about its own length; prickles similarly colored, mostly 10–20 mm. apart, very unequal, 4–8 mm. long, triangular, lunately enlarged onto

the tops of fleshy prominences between which the margin is usually concave, mostly curved or somewhat hooked, especially upwardly. Inflorescence 2–4 m. high, the upper half paniculate; scape stout: branches numerous, elongated, openly branched: pedicels scarcely 5 mm. long. Flowers golden yellow, goblet-shaped, 45-50 mm. long: ovary 20–25 mm. long, scarcely equaling the perianth, oblong-fusiform: tube 8 mm. deep: segments about 6 × 15–20 mm., typically more than twice as long as the tube: filaments inserted below the middle of the tube, about 40 mm. long and twice as long as the segments. Capsules oblong, 20 × 55 mm., shortly and obscurely stipitate and beaked: seeds glossy, broad, 6 × 8 mm.

Eastern Lower California.—*Aurea,*—golden, because of the color of its flowers. *Map* (F). *Pl. 32-34.*

Specimens examined:—Purisima (*Brandegee,* Feb. 13, 1889,—the type). Comondu (*Nelson and Goldman, 7274,* Nov. 6, 1905, with deeper tube and shorter lobes than the type).

If the name *aurea* were to be displaced because of its earlier application as a specific name to the variegated century plant (Jolyclerc, Syst. Sex. des Végét. **1:** 268. 1799), this type of a most striking group of Lower Californian agaves might well be called *A. campaniflora* because of the characteristic form of its flowers.

Agave promontorii Trelease.

A. aurea Brandegee, Proc. Cal. Acad. ii. 3:174. 1891—? Dodge, Rept. Fiber Invest. 9;44.—? De Laet, Cat. 1904:38; 1906: 30. —? Braun, Pflanzer. 2:219. —? Rose, Contr. U. S. Nat. Herb. 5:247.—? Bois & Gallaud, C. Rend. Acad. Paris. 141: 1033.—? Endlich, Beihefte Tropenflanzer. 9;281.

Agave sp. Brandegee, Proc. Cal. Acad. ii. 3:227. no. 728.

Aspect of *A. aurea.* Leaves more glaucous with rather heavier and more curved and awl-pointed spine but similar prickles. Inflorescence 4–6 m. high, the upper half or two-thirds paniculate: scape very stout: bracts not overlapping, spreading: branches numerous, decompound, the lower somewhat recurved; pedicels scarcely 5 mm. long. Flowers golden, cup-shaped, 50–55 mm. long: ovary 25–30 mm. long, finally exceeding the perianth, rather oblong: tube 10–12 mm. deep: segments about 8 × 10–15 mm., scarcely one-half longer than the tube and sometimes barely equaling it: filaments inserted about the lower third of the tube, 40–45 mm. long, and about thrice as long as the segments. Capsules shortly pyriform-oblong, 15–20 × 30–35 mm., rather stipitate, beaked: seeds narrow, 4–5 × 6–9 mm.

Southern Lower California.—*Promontorii,*—of the cape, from its locality.—*Map* (G). *Pl. 35-37.*

Specimens examined:—Sierra de la Laguna (*Brandegee,* Apr. 26, 1892; *Nelson and Goldman, 7437,* Jan. 21, 1906,—the type). Cabo San Lucas (*Brandegee,* Mar. 18, 1892; *Rose, 16326,* Mar. 23, 1911; *Grabendörfer,* 1899; and cultivated at San Diego by Brandegee in 1903). San Jose del Cabo (*Purpus,* Jan.-March 1901,—intermixed with *A. Brandegeei*).

Dr. Rose assures me that the coastwise plants are less massive than the Goldman photograph shows the type to be, and further material may prove them to be separable.

Agave dentiens Trelease.

Somewhat cespitose, acaulescent. Leaves spreading, glaucous gray-green, transversely banded, essentially smooth, elongated-triangular, gradually acute, concave, becoming channeled near the end, 3–5 × 30–50 cm., very thick and aloe-like; spine triquetrously conical, nearly straight, ashen or by abrasion dull light brown, 3–4 × 20–30 mm., involutely slit to beyond the middle, usually very long-decurrent: prickles dingy brown or whitish, 5–10 mm. apart, scarcely 1 mm. long, mammaeform, very weak and friable, the intervening margin straight. Inflorescence 3–4 m. high, more than the upper half paniculate with few slender outcurved-ascending branches irregularly branched at the end: pedicels slender, scarcely 5 mm. long. Flowers? Capsules light brown, glaucous, 20 × 50 mm., stipitate and beaked: seeds?

Gulf Islands of Sonora rather than Lower California.—*Dentiens,*—teething, because of the rudimentary prickles on the margins of its leaves.—*Map* (H). *Pl. 38-40.*

Specimens examined:—San Esteban Island (*Rose, 16819,* Apr. 13, 1911,—the type).

The least prickly of the agaves here considered: more likely to have entered by way of the Mexican mainland and Tiburon Island than through the peninsula, from which San Esteban Island is separated by very deep water; perhaps not really of the same alliance as the species centering about *A. deserti.*

Agave disjuncta Trelease.

? *Agave* sp. Vasey & Rose, Contr. U. S. Nat. Herb. 1: 20.

Habit? Leaves ascending, glaucous, smooth, oblong-triangular, concave: spine acicular, nearly straight, slit-grooved to the middle,

somewhat decurrent: prickles brown, moderately distant, minute, triangular with the cusps upcurved above and recurved below. Inflorescence, flowers and fruit unknown.

Pacific Islands of middle Lower California.—*Disjuncta*,—isolated, because of its occurrence apart from what appear to be its closest relatives.—*Map* (I).

Specimens examined:—San Benito Island (*Rose, 41*, 1911, —small living plants only).

Closely comparable, in young specimens, with *A. dentiens* only, from which it differs in its firmer more acicular prickles: differing from other known Deserticolae in the small size of its prickles.

AGAVE DESERTI Engelmann, Trans. Acad. St. Louis. **3**: 310, 370. 1875; Bot. Works. 309, 316.—Gartenflora. **25**: 154.—L. de Smet, Cat. 10: 1, 31, 33.—Baker, Gard. Chron. n. s. **7**; 717; Handbook Amaryllid. 172; Kew Bull. **1892**: 3, and Add. Ser. **2**: 219.—Ricasoli, Bull Soc. Tosc. Ort. **3**; 212.—Peacock, List. 2.—Palmer, Amer. Journ. Pharm. **50**; 588.—Orcutt, Gard. & For. **3**: 450; W. A. Sci. **6**: 22; **7**: 95.—Terracciano, Primo Contributo. 49.—Nicholson, Dict. **1**; 40; Dict. Prat. **1**; 82.—Dodge, Rept. Fiber Invest. 9: 46. *f. 10*.—Mulford, Rept. Mo. Bot. Gard. **7**: 79. *pl. 33–34*.—Kew Hand List Tend Monocot. 111.—Rose in Bailey, Cyclop. **1**: 34.—Segura, El Maguey. 4 ed. 72.—? Braun, Pflanzer. **2**: 219.—Endlich, Beihefte Tropenpfl. **9**: 279.—Mittheil. D. Dendrol. Ges. 2 ed. 191.—Abrams, Bull. N. Y. Bot. Gard. **6**: 321.

A. americana Emory, Notes Milit. Recon. 104, 152. 1848.

A. deserti humilis L. de Smet, Cat. **10**: 1, 31, 33.

Densely cespitose, acaulescent. Leaves gray, sometimes transversely banded, slightly granular-roughened, triangular-lanceolate, gradually acute, openly concave becoming rather channeled near the end, about 5 × 15–30 cm., falcately ascending: spine from dull brown becoming gray, compressed-conical or acicular, nearly straight, about 3 × 30 mm., round-grooved below the middle or involute: prickles similarly colored, rather friable, 5–10 mm. apart, 3–4 mm. long, triangular, mostly reflexed, hardened onto the tops of low fleshy prominences between which the margin is nearly straight. Inflorescence 2–3 m. high, the top, only, paniculate: scape slender: bracts separated, ascending: branches few, short, ascending, compactly short-

branched; pedicels slender, about 5 mm. long, irregularly fasciately coherent. Flowers chrome-yellow, rather fetid, about 35 mm. long: ovary flask-shaped with a distinct neck, 15–20 mm. long, about equaling the perianth; tube 3–4 mm. deep: segments about 4 × 15 mm., much longer than the tube but shorter than the ovary: filaments inserted nearly in the throat, 25–30 mm. long and nearly twice as long as the segments. Capsules about 15 × 45 mm., scarcely stipitate but beaked: seeds about 4 × 5 mm.

Western border of the Colorado Desert in California at an altitude of about 3,000 feet.—*Deserti,*—of the desert, from its habitat. *Pl. 41, 42.*

Specimens examined:—CALIFORNIA. East of San Felipe (*Emory,* 1846; *Hitchcock,* 1875; *Palmer,* 1875,—the types).

Not known to extend into Lower California, but introduced here because of the close relationship borne it by the next two species.

Agave consociata Trelease.

A. deserti Orcutt, Bull. Torr. Bot. Cl. 10 : 107. 1883.— de Wildeman, Icon. Sel. Hort. Thenens. 6. *pl. 204.*
? *A. Pringlei* Simon, Cat. [1900] : 16.
Agave sp. MacDougal, Publ. Carnegie Inst. 99 : 43.

Aspect of *A. deserti.* Leaves more oblong, nearly smooth, about 6 × 20–30 cm.: spine brown, becoming drab toward the base, variously acicular-conical or compressed, straight, 3–4 × 25–30 mm., openly grooved below the middle or involutely closed: prickles similarly colored, rather firm, 10–25 or 30 mm. apart, 4–8 mm. long, triangular, nearly straight or variously curved, the intervening margin at most gently undulated. Inflorescence 5–7 m. high: pedicels as in *A. deserti.* Flowers 40–50 mm. long: ovary fusiform, 25–30 mm. long, considerably exceeding the perianth: tube about 5 mm. deep: segments 5 × 15 mm., much longer than the tube but only about half as long as the ovary: filaments inserted nearly in the throat, scarcely 30 mm. long or twice as long as the segments. Capsules light brown, 15 × 35 mm., scarcely stipitate, beaked; seeds?

Associated with *A. deserti* from which it differs in ovary and prickles, and extending into the Lower California desert at about the same altitude.—*Consociata,*—of the alliance, because of its relations to *A. deserti.*—*Map* (J). *Pl. 43.*

Specimens examined:—CALIFORNIA. San Felipe (*Parish, 413,* June 1882,—the type). Mountain Springs (*Parish,*

1880). Eastern base of San Jacinto Mountains (*Hall, 2117,* June 1901). Lower California. Nachoguero Valley (*Mearns, 3399,* June 3, 1894). Alamo (*Goldman, 1142,* June 11, 1905, with blackening end-spine). Cucopa Mountains (*MacDougal, 182,* 1905).

Agave Pringlei Engelmann ined. Orcutt, Bull. Torr. Bot. Cl. **10**: 107. 1883; W. Amer. Sci. **7**: 95. 1891,—name only.—Baker, Handbook Amaryllid. 182. 1888.—Ricasoli, Utilita dei Giardini d' Acclimazione. Suppl. 1: 2.—Kew List Tend. Monocot. 119.—Terracciano, Boll. Ort. Bot. Palermo. **1**: 25.—Rose in Bailey, Cyclop. **1**: 34.—Segura, El Maguey. 4 ed. 96.—? Braun, Pflanzer. **2**: 226.—? Müller, Bot. Zeit. Abt. I. **67**: 113, 135.

Aspect of *A. deserti.* Leaves triangular-oblong, essentially smooth, about 5 × 15–40 cm.: spine drab with glossy brown apex, acicular, nearly straight, 3–5 × 25–35 mm., openly grooved below the middle or involute: prickles similarly colored, more or less firm, 15–25 mm. apart, 3–5 mm. long, triangular, rather straight or upcurved, somewhat lenticularly hardened into the nearly straight margin. Inflorescence as in *A. deserti,* with rather more divided branches, about 2 m. high. Flowers 40–50 mm. long: ovary fusiform, in age developing a rather long neck, 25–30 mm. long, considerably exceeding the perianth; tube 4–6 mm. deep: segments about 4 × 15 mm., much longer than the tube and fully half as long as the ovary: filaments inserted nearly in the throat, 30–35 mm. long, rather more than twice as long as the segments. Capsules beaked, becoming grayish straw-color, otherwise strikingly diverse: narrow (12 × 45 mm.), evidently stipitate and slender-pediceled; or short (15 × 30–35 mm.), little stipitate and stouter-pediceled; seeds 3–4 × 5–7 mm.

Mountains of Lower California, at an altitude of about 6,000 feet.—*Pringlei,*—C. G. Pringle,—the most extensive and best collector of Mexican plants.—*Map* (K). *Pl. 44.*

Specimens examined:—Central plateau (*Pringle,* April 1882,—the type of *A. Pringlei* Engelm. in herb.). Central mountains (*Orcutt,* Oct. 7, 1882, distributed without number by Pringle,—the type of *A. Pringlei* as described by Baker). Pinery, Hanson's ranch (*Orcutt, 943,* July 26, 1883). Pinône forest (*Orcutt,* Aug. 1, 1883).

Agave cerulata Trelease.

? *Agave* sp. Brandegee, Proc. Cal. Acad. ii. **2** : 208.
? *A. deserti* Purpus, Monatsschr. f. Kakteenk. **9** : 37. 1899; Cactus Journ. **2** : 54.—Weber, Bull Mus. Hist. Nat. **8** : 223.
? *A. Diguetii* Simon, Cat. [1900]: 15, not Weber !—Name only.

Habit? Leaves grayish [or glaucous, slightly granular-roughened, linear- or oblong-triangular, gradually acute, deeply concave, becoming channeled near the end, 2–4 × about 30 cm.: spine acicular, nearly straight, finally gray-brown, 2 × 25–30 mm., slit-grooved below, decurrent for scarcely its own length: prickles dull brown, graying, 10 or 15–25 mm. apart, scarcely 3 mm. long, mammaeform or triangular, friable and easily detached, on fleshy prominences between which the margin is rather straight. Inflorescence 3–4 m. high, slender, paniculate, with the ultimate branches subracemosely fasciate, at first blue-waxen, much as in *Negundo:* pedicels thick, free for scarcely 5 mm. Flowers yellow, 35 mm. long: ovary stout, 5 × 15–20 mm., oblong, rather exceeding the perianth: tube cup-shaped, about 3 mm. deep: segments oblong, 4 × 12–15 mm., much exceeding the tube and approximating the ovary in length: filaments inserted nearly in the throat, about 25 mm. long, and little more than twice as long as the segments. Capsules pyriform-oblong, thick-walled, glaucous, 20 × 55 mm., scarcely stipitate and little beaked: seeds?

Central Lower California, south from Calmalli.—*Cerulata,* —touched with wax, from its glaucous inflorescence.—*Map* (L.) *Pl. 45-47.*

Specimens examined:—Calmalli (*Miller and Rose, 4013,* Oct. 30, 1897; *Nelson and Goldman, 7180,* Sept. 29, 1905, —the type). San Benito (*Brandegee,* Apr. 10, 1889).

Agave carminis Trelease

Habit? Leaves smooth, gray-green, triangular-oblong, acute, thick, becoming channeled near the end, about 5 × 30–40 cm.: spine slightly glossy, from light brown becoming rather gray, acicular, gently a little upcurved, 2 × 35 mm., slit-grooved to the middle, very long-decurrent; prickles similarly colored, firm, 20–30 mm. apart, about 5 mm. long, narrowly triangular, variously and irregularly curved, slightly lunately widened onto the tops of low fleshy prominences between which the margin is nearly straight. Inflorescence paniculate with slender scape and short ascending nearly simple branches at the ends of which the very short but rather thick pedicels are compactly clustered. Flowers and fruit?

Island region of east-central Lower California.—*Carminis,* —of Carmen Island, where it occurs.—*Map* (M). *Pl. 48, 49.*

Specimens examined:—Carmen Island (*Rose, 16639,* April 3, 1911,—the type).

AGAVE SOBRIA Brandegee, Proc. Cal. Acad. ii. **2**: 207. 1889: Gard. & For. **3**: 106.

Habit? Acaulescent. Leaves smooth, glaucous, lanceolate, 60 cm. long: spine?,— said not to be decurrent: prickles chestnut, rather dull and glaucous, usually 20–30 mm. apart, 8–10 mm. long, narrowly triangular, variously curved, sometimes a little lunately widened onto the tops of low fleshy prominences between which the margin is straight or concave. Inflorescence not over 5 m. high, the upper third paniculate. Flowers light greenish yellow, 45–50 mm. long: ovary 20–25 mm. long, fusiform-oblong: tube cup-shaped, 5 mm. deep: segments oblong, 4 × 20–22 mm., much exceeding the tube and about as long as the ovary; filaments inserted nearly in the throat, 40–45 mm. long, about twice as long as the segments. Capsules brown, broadly oblong, 20–55 mm., scarcely stipitate or beaked: seeds?

East-central Lower California, north from Comondu.—*Sobria,*—not given to alcohol, it being reputed of no use for the preparation of mezcal.—*Map* (N). *Pl. 50, 51.*

Specimens examined:—Comondu mesas (*Brandegee, 2,* Mar. 23, 1889,—the type). San Esteban (?*Brandegee,* Apr. 17, 1889). Cardon Grande (?*Brandegee,* Apr. 22, 1889).—The last two numbers, without leaf-material, have flowers and capsules of this rather than the associated *A. cerulata.*

Agave affinis Trelease.

?*Agave* sp. Brandegee, Proc. Cal. Acad. ii. 2: 208. 1889.

Habit? Leaves scabrous, glaucous, gray-green, triangular-oblong, becoming channeled near the end, about 5 × 50 cm.: spine dull, light brown to ashen or nearly white, compressed-acicular, gently somewhat undulate, 2–3 × 30–50 mm., slit-grooved toward the base, long-decurrent; prickles similarly colored, 10–20, 30 or even 40 mm. apart, 5–7 mm. long, narrowly triangular, nearly straight, somewhat lunately widened onto the tops of fleshy prominences between which the margin is more or less concave. Inflorescence paniculate with short branches: pedicels thick, less than 5 mm. long. Flowers? Capsules light brown, oblong, 15–20 × 40–50 mm., stipitate and beaked: seeds?

Eastern Lower California.—*Affinis,*—related to, because of its resemblances to *A. sobria,* from which, so far as known, it differs mainly in its rough leaves, lighter brown prickles

and more beaked and stipitate capsules.—*Map* (O). *Pl. 52, 53.*

Specimens examined:—Head of Concepcion Bay (*Rose, 16676,* Apr. 5, 1911.—the type).

Possibly the nondescript *A. scaberrima* and the erroneously named *A. Diguetii* belong here rather than under *A. deserti.*

Agave Brandegeei Trelease.

? *Agave* sp. Brandegee, Proc. Cal. Acad. ii. 3 : 227, no. 728.

Habit? Leaves smooth, grayish yellow-green, lanceolate, gradually acute, about 10 × 60 cm.: spine stoutly conical-awl-shaped, recurving, glossy, red-brown, 4 × 20 mm., involutely grooved to above the middle, decurrent for about its own length: prickles chestnut, firm and rather glossy, about 10 mm. apart, 2 mm. long, gently upcurved or occasionally hooked, obliquely deltoid, their bases 4 mm. wide, the intervening margin straight. Inflorescence paniculate: pedicels scarcely 5 mm. long. Flowers apparently yellow, 45 mm. long: ovary 5 × 25–30 mm., fusiform: segments 3 × 12–15 mm., much longer than the tube but less than half as long as the ovary: filaments inserted nearly in the throat, 30–40 mm. long, two or three times as long as the segments. Fruit?

Southern Lower California.—*Brandegeei,*—T. S. Brandegee, an extensive collector and excellent student of many plants of widely separated parts of arid North America.—*Map* (P). *Pl. 54.*

Specimens examined:—Cape region mountains (*Brandegee,* Sept. 20, 1899,—the type). San Jose del Cabo (*Purpus,* Jan.-March 1901).—Both collections are intermixed with flowers of *A. promontorii.*

AGAVE MARGARITAE Brandegee, Proc. Cal. Acad. ii. **2** : 206. *pl. 10.* 1889.— Franceschi, Gard. & For. **8** : 228.—Kew Hand List Tend. Monocot. 115.—Rose in Bailey, Cyclop. **1** : 36.

Cespitose, acaulescent. Leaves green, dull, glaucous and transversely banded, essentially smooth, nearly round to obovate-oblanceolate, acuminate, openly concave, channeled toward the end, 6–10 × 12–20 cm., rather openly spreading: spine from chestnut becoming dull gray, acicular, slightly wavy, 3 × 25 mm., round-grooved below the middle, decurrent for its own length or less: prickles similarly colored, about 10 mm. apart, 6–8 mm. long, narrowly triangular, pre-

vailingly down-curved below and upcurved above, little widened onto the tops of low fleshy prominences between which the margin is somewhat concave. Inflorescence 3–4 m. high, the upper third or less paniculate with short outcurved-ascending little-divided branches: pedicels 2–3 mm. long. Flowers light yellow, 45–50 mm. long: ovary 25–30 mm. long, fusiform: tube deep for the group, about 10 mm.: segments attenuate, short, 5 × 15 mm., one-half longer than the tube and about half as long as the ovary: filaments inserted nearly in the throat of the tube, scarcely 25 mm. long and less than twice as long as the segments. Capsules brown, oblong or pyriform, 15–20 × 30–50 mm., not stipitate but somewhat beaked: "seeds 3–4 mm. in diameter, smooth."

Islands of southwestern Lower California.—*Margaritae,*—of Santa Margarita Island, where it is said to occur.—*Map* (Q). *Pl. 55, 56.*

Specimens examined:—Magdalena Island (*Brandegee,* Jan. 14, 1889,—the type; *Rose, 16316,* Mar. 21, 1911).

Agave connochaetodon Trelease.

Cespitose, acaulescent. Leaves pale green, somewhat glaucous, dull, essentially smooth, oblanceolate, acuminate, openly concave, channeled toward the end, 6 × 25 cm.: spine from dull red becoming drab and then ashen, compressed-acicular, flexuous, 3–4 × 40–50 mm., round-grooved below the middle, decurrent for about its length: prickles dull red or brown, 15–20 mm. apart, 10–15 mm. long, elongated-triangular, prevailingly down-curved below, upcurved above, often with flexed base, little widened on the tops of rather large fleshy prominences between which the margin is deeply concave above. Inflorescence 3 m. high, slender, with few horizontal compound branches: pedicels about 3 mm. long. Flowers? Capsules dark, oblong, 15 × 35–40 mm., not stipitate, beaked: seeds?

Southwestern Lower California.—*Connochaetodon,*—gnu-toothed, because of the peculiar curvature of the prickles.—*Map* (R). *Pl. 57.*

Specimens examined:—Sta. Maria Bay (*Rose, 16261,* Mar. 18, 1911,—the type).

Santa Margarita and Magdalena Islands are scarcely detached portions of the mainland, the former cut off by a narrow channel scarcely reaching a depth of fifty feet, and the latter by wider shoals covered by scarcely one-fifth this depth of water. There is no reason to suppose that an agave

found on one should not occur on the other or on the mainland, nor is there evident reason for specific differentiations. It is, therefore, with considerable hesitancy that, because of the very different arming of the specimens collected, a second species is recognized for these islands.

Agave Roseana Trelease.

Somewhat cespitose, acaulescent. Leaves glaucous gray-green, the neck somewhat transversely banded, smooth, broadly lanceolate, somewhat acuminate, openly concave, as much as 15 × 50 cm., stiffly somewhat spreading: spine from glaucous purplish chestnut becoming dull ashen, compressed-acicular, tortuous, 3–4 × 50–70 mm., round-grooved to or beyond the middle, decurrent: prickles from glaucous brown soon becoming pinkish drab or creamy, about 30 mm. apart, 10–25 mm. long and sometimes 10 mm. wide, mostly broadly triangular, variously and very irregularly curved, hooked or doubly flexed, usually rather abruptly or lunately dilated, sometimes to a width of 15 mm., onto the tops of large fleshy prominences between which the margin is either straight or very concave. Inflorescence 2–3 m. high, narrowly paniculate at top: scape slender: branches very compactly short-branched at the end: pedicels slender, varying from 2–7 mm. in length. Flowers 40–50 mm. long: ovary 25–30 mm. long, fusiform-oblong: tube saucer-shaped, 2–3 mm. deep: segments 3 × 12–15 mm., very much longer than the tube and half as long as the ovary: filaments inserted nearly in the throat, 30–35 mm. long, more than twice as long as the segments.

Southeastern Lower California.—*Roseana*,—J. N. Rose, a critical student and expert collector of many groups of North American plants, whose field work is a model for those desirous of advancing knowledge of such difficult plants as the present genus offers.—*Map* (S). *Pl. 58-60.*

Specimens examined:—La Paz (*Brandegee*, Apr. 14, 1892). On peninsula opposite Pichilinque Island (*Rose, 16524*, Mar. 28, 1911). Espiritu Santo (*Rose, 16854*, Apr. 18, 1911,—the type).

A remarkable species, alike in its very slender long tortuous spine—sometimes long-continued by the similarly wavy horny-margined leaf-tip, and its very large flat marginal teeth,—in both respects recalling some of the marginate Littaeas.

Agave avellanidens Trelease.

Agave sp. Brandegee, Proc. Cal. Acad. ii. **2**: 208. 1889.

Habit? Leaves smooth, broadly lanceolate, long-acuminate, rather channeled toward the end, 11 × upwards of 60? cm.: spine drab, slightly polished at the end only, narrowly conical, wavy, 5 × 50 mm., round-grooved to beyond the middle, long-decurrent: prickles similarly colored, glossy, 25–50 mm. apart or with a smaller one intercalated, as much as 10 mm. long and 5 mm. wide, broadly triangular, variouly and unequally gently curved, somewhat lunately dilated to about 10 mm. onto the tops of broad very low elevations of the little repand margin. Inflorescence paniculate: pedicels 5–10 or 12 mm. long, rather slender. Flowers 60 mm. long: ovary 35 mm. long, fusiform: tube 5 mm. deep: segments 4 × 20 mm., very much longer than the tube and more than half as long as the ovary: filaments inserted in the throat of the tube, 40 mm. long and twice as long as the segments. Capsules dark brown, broadly oblong, 20 × 35 mm., not stipitate and scarcely beaked: seeds?

East-central Lower California.—*Avellanidens,*—filbert-toothed, from the nut-color of its prickles.—*Map* (T). *Pl. 61, 62.*

Specimens examined: Paraiso (*Brandegee, 6,* May 1, 1889,—the type).

Agave subsimplex Trelease.

Habit? Leaves very glaucous, somewhat transversely banded below, nearly smooth, broadly oblong- or elliptical-lanceolate, slightly acuminate, about 5 × 15 cm.: spine slightly curved, shortly acicular, dull ashen-gray, 3 × 20 mm., round-grooved below the middle, little-decurrent: prickles from blackish purple or through yellow and scarlet becoming similarly colored, 10–20 mm. apart, 5–10 mm. long, narrowly triangular, mostly upcurved above and recurved below, little widened into the tops of rather high fleshy prominences between which the margin is rather straight. Inflorescence slender, narrowly paniculate, the lower branches short-branched, the upper nearly simple: pedicels extremely short. Flowers? Capsules brown, apparently varying greatly and almost inconceivably: short (15 × 30 mm.) and rather obscurely stipitate and beaked; or much larger (20 × 65 mm.) with prominent beak and long stipitate contraction: seeds about 4 × 5 mm.

Gulf Islands of Sonora.—*Subsimplex,*—nearly unbranched, from its inflorescence.—*Map* (U). *Pl. 63, 64.*

Specimens examined:—Seal Island, just off Tiburon Island. (*Rose, 16811,* Apr. 13, 1911,—the type).

The distributional remarks under *A. dentiens* pertain also to this species.

Agave Nelsoni Trelease.

A. Shawii Nelson, Nat. Geogr. Mag. **22**: 449, 451. *ff.* 1911.

Cespitose, acaulescent. Leaves smooth, glaucous, lance-oblong or ovate-oblong, little acuminate, openly concave, about 7×18–35 cm., stiffly erect-spreading: spine straight, half-conical, dull grayish or blackish, 5×30 mm., very openly grooved to the upper third, decurrent for about its own length: prickles fragile and easily detachable, fading from dull brown, 10–20 mm. apart, about 5 mm. long, broadly triangular, lightly curved, especially upwards. Inflorescence 3–8 m. high, paniculate only at the top: scape slender: bracts rather distant, appressed: branches few, short, ascending or upcurved, tripartite: pedicels about 5 mm. long. Flowers light yellow, cup-shaped, 40–50 mm. long: ovary 20–30 mm. long, fusiform: tube extremely short, 2–3 mm. deep: segments rather elliptical, 4–7×15–17 mm., decidedly shorter than the ovary: filaments inserted on the outer part of the nearly flat floor of the tube, 30–35 mm. long and twice as long as the segments. Fruit?

North-central Lower California, at an altitude of 1400-1800 feet.—*Nelsoni,* E. W. Nelson, one of the most expert field students of the geographic distribution of North American animals and plants.—*Map* (V). *Pl. 65-67.*

Specimens examined:—San Fernando (*Nelson and Goldman, 7111,* Sept. 4, 1905,—the type). Onyx (*Nelson and Goldman, 7117,* Sept. 7, 1905,—with more elongated leaves and larger flowers, on which, perhaps, it is differentiable).

AGAVE DATYLIO Simon, Cat. **[1900]**: 15,—name only.—Weber. Bull. Mus. Hist. Nat. **8**: 223. 1902.

Agave sp. Brandegee, Proc. Cal. Acad. ii. 3: 174, 227. nos. 581, 729.

Cespitose, acaulescent. Leaves yellowish gray-green, smooth, oblong-lanceolate, channeled above, 3–4×30–75 cm., fleshy, rigid: spine nearly straight, stoutly triquetrously conical, from glossy purplish brown becoming blackish or gray, 4–6×20–30 mm., little decurrent, very shallowly and openly grooved near the base: prickles from glossy chestnut becoming dull grayish brown, 20–30 or even 50 mm. apart, 3–5 mm. long, triangular and mostly recurved from heavy or lenticular bases or the narrowed cusps lacking. Inflorescence 4–5 m. high, lightly glaucous, the slender scape branches moderately short-

branched at end: pedicels under 5 mm. long. Flowers 45–55 mm. long: ovary about 22 mm. long, glaucous, stoutly fusiform: tube 8–10 or even 12 mm. deep: segments 3–4 × 12–15 or 20 mm., considerably exceeding the tube and more than half as long as the ovary: filaments inserted about the middle of the tube, 35–45 mm. long and more than twice as long as the segments, with typically very long (30 mm.) anthers. Capsules brown, broadly oblong or pyriform, about 20 × 35–40 mm., stipitate and shortly beaked: seeds 6 × 7 mm.

Southern Lower California.—*Datylio,*—said by the author of the species to be its local vernacular name.—*Map* (W). *Pl. 68, 69.*

Specimens examined:—La Paz—the type locality (*Rose, 1302,* June 14, 1897; *16540,* Mar. 29, 1911; *Brandegee,* 1899). San Pedro (*Brandegee, 581,* Oct. 29, 1891).

Agave vexans Trelease.

Habit? Leaves grayish green, smooth, linear-triangular, very gradually acute, openly concave becoming channeled toward the end, 2 × 20–45 cm., stiff and straight: spine dull gray-brown, triquetrously conical, essentially straight, 3–5 × 25–35 mm., grooved in the lower part: prickles fading from dull dingy brown, rather easily detachable, 15–20 or 30 mm. apart, 3–4 mm. long, heavily triangular, or with somewhat slender cusps. Inflorescence 1.5–2 m. high, lightly glaucous, the slender scape with slender outcurved-ascending branches short-branched at the end: pedicels scarcely 5 mm. long. Flowers apparently greenish, about 40 mm. long: ovary glaucous, 20–25 mm. long, fusiform or flask-shaped: tube about 8 mm. deep; segments 3–4 × 12–15 mm., about twice as long as the tube and more than half as long as the ovary: filaments inserted about the middle of the tube, scarcely 25 mm. long or twice as long as the segments, with rather short (15 mm.) anthers. Capsules light gray-brown, broadly oblong, 20 × 35–45 mm., shortly stipitate, conspicuously beaked: seeds 5 × 6 mm.

East-central Lower California.—*Vexans,*—annoying, because of its occurrence apart from its close relative, *A. Datylio. Map* (X). *Pl. 70-72.*

Specimens examined:—Purisima? (*Brandegee,* 1889). Paso de los Dolores to Lake Ramon (*Brandegee,* April 4, 1889). Near El Potrero, below Mulege (*Nelson and Goldman, 7237,* Oct. 31, 1905,—the type).

EXPLANATION OF PLATES.

All of the illustrations are from herbarium specimens unless otherwise noted; herbarium sheets are uniformly reduced to one-third natural size; details are of natural size. For the habit figures I am under great obligation to the gentlemen whose names are mentioned in connection with the explanation of them. On the distribution map, the localities at which collections have been made are marked by circles accompanied by indicative letters that are referred to in the text.

Plate 18.—*Agave* in Lower California. The distribution of the groups evident from accompanying legend.

Plate 19.—*Agave Shawii*. A characteristic group of plants near San Diego. Reproduced from Rept. Mo. Bot. Garden. 7. *pl. 44*.

Plate 20.—*Agave Shawii*. 1, Upper portion of leaf of type, in the Garden herbarium. 2, An opened flower from a plant from the type locality that bloomed in the Missouri Botanical Garden in 1877.

Plate 21.—*Agave Shawii*. Capsules and seeds of type.

Plate 22.—*Agave Orcuttiana*. Leaf and opened flower of type, in the Garden herbarium.

Plate 23.—*Agave sebastiana*. Habit of growth on Cedros Island. Enlarged from a negative made by Dr. C. H. Townsend in 1911. About ¼₀ natural size.

Plate 24.—*Agave sebastiana*. A co-type (Cedros Island, *Greene*, May 1, 1885), in the herbarium of the University of California.

Plate 25.—*Agave sebastiana*. Foliage armed as in *A. Shawii*. (Cedros Island, *Rose*, *16122*).

Plate 26.—*Agave sebastiana*. 1, Margin, opened flower and capsule (San Benito Island, *Rose*, *16041*). 2, Spine and capsule (Cedros Island, *Rose*, *16122*).

Plate 27.—*Agave pachyacantha*. Spines and margins of the type.

Plate 28.—*Agave pachyacantha*. Flowers, leaf margin and capsules (Colnett, *Brandegee*, May 1893).

Plate 29.—*Agave Goldmaniana*. Habit of growth. Enlarged from a photograph by E. A. Goldman; published by permission of the Bureau of Biological Survey of the United States Department of Agriculture. About ¼₀ natural size.

Plate 30.—*Agave Goldmaniana*. Type (Yubai, *Nelson & Goldman*, *7151*), in the National Herbarium.

Plate 31.—*Agave Goldmaniana*. Details, from the type sheet.

Plate 32.—*Agave aurea.* Type (Purisima, *Brandegee*, Feb. 13, 1889), in the herbarium of the University of California.

Plate 33.—*Agave aurea.* Details from the type sheet.

Plate 34.—*Agave aurea.* Bract-tip, spine, prickles, flower and capsule from Comondu (*Nelson & Goldman, 7274*), in the National Herbarium.

Plate 35.—*Agave promontorii.* Habit of growth. Enlarged from a photograph by E. A. Goldman: published by permission of the Bureau of Biological Survey of the United States Department of Agriculture. About 1/40 natural size.

Plate 36.— *Agave promontorii.* Type (Sierra la Laguna, *Nelson & Goldman, 7437*), in the National Herbarium.

Plate 37.—*Agave promontorii.* 1, Pedicels and flowers, one opened (San Jose del Cabo, *Purpus*, 1901). 2, Spine, prickles and capsules (Cabo San Lucas, *Rose, 16326*).

Plate 38.—*Agave dentiens.* Habit of growth on San Esteban Island. Enlarged from a negative made by Dr. Paul Bartsch in 1911. About 1/30 natural size.

Plate 39.—*Agave dentiens.* Type (San Esteban, *Rose, 16819*), in the National Herbarium.

Plate 40.—*Agave dentiens.* Details, from the type sheet.

Plate 41.—*Agave deserti.* Habit of growth near San Felipe in the Colorado desert of southern California. Enlarged from an old stereoscopic print by Parker. About 1/15 natural size.

Plate 42.—*Agave deserti.* Leaf and flowers of type material (the upper flower collected by Emory in 1846), in the Garden herbarium.

Plate 43.—*Agave consociata.* Spine, prickles, pedicels and flowers, from the eastern base of the San Jacinto Mountains (*Hall, 2117*).

Plate 44.—*Agave Pringlei.* 1, Spines, prickles and rough-dried flowers, one opened, of the type exsiccata. 2, Capsules and seeds of the two forms of fruit collected by Orcutt with the preceding material, but apparently distributed in only a few of the sets.

Plate 45.—*Agave cerulata.* Type (Calmalli, *Nelson & Goldman, 7180*), in the National Herbarium.

Plate 46.—*Agave cerulata.* Details, from the type sheet.

Plate 47.—*Agave cerulata.* Leaf-tip and part of fruiting inflorescence from San Benito (*Brandegee*, April 10, 1889), in the herbarium of the University of California.

Plate 48.—*Agave carminis.* Type (Carmen Island, *Rose, 16639*), in the National Herbarium.

Plate 49.—*Agave carminis.* Details, from the type sheet.

Plate 50.—*Agave sobria.* Type (Comondu, *Brandegee, 2*, March 23, 1889), in the herbarium of the University of California.

Plate 51.—*Agave sobria.* Details, from the type sheet.

Plate 52.—*Agave affinis.* Type (Head of Concepcion Bay, *Rose, 16676*), in the National Herbarium.

Plate 53.—*Agave affinis.* Details, from the type sheet.

Plate 54.—*Agave Brandegeei.* 1, Spine and basal prickles of the type (Cape region mountains, *Brandegee*, Sept. 20, 1899), in the Garden herbarium. 2, Prickles and flowers of the same collection in the herbarium of the University of California.

Plate 55.—*Agave margaritae.* Type (Magdalena Island, *Brandegee*, Jan. 14, 1889), in the University of California herbarium.

Plate 56.—*Agave margaritae.* 1, Flowers, from the type sheet. 2, End of branch of fruiting panicle (Magdalena Island, *Rose, 16316*), in the National Herbarium.

Plate 57.—*Agave connochaetodon.* Spines, prickles and fruit of the type (Sta. Maria Bay, *Rose, 16261*), in the National Herbarium.

Plate 58.—*Agave Roseana.* Type (Espiritu Santo, *Rose, 16854*), in the National Herbarium.

Plate 59.—*Agave Roseana.* Details, from the type sheet.

Plate 60.—*Agave Roseana.* Leaf and flower details (La Paz, *Brandegee*, Apr. 14, 1892), from material in the herbarium of the University of California.

Plate 61.—*Agave avellanidens.* Type (Paraiso, *Brandegee, 6*, May 1, 1889), in the herbarium of the University of California.

Plate 62.—*Agave avellanidens.* Details, from the type sheet.

Plate 63.—*Agave subsimplex.* Type (Seal Island, *Rose, 16811*), in the National Herbarium.

Plate 64.—*Agave subsimplex.* Details, from the type sheet.

Plate 65.—*Agave Nelsoni.* Habit of growth in a characteristic *Idria* association. Enlarged from a photograph by E. A. Goldman: published by permission of the Bureau of Biological Survey of the United States Department of Agriculture. About 1/30 natural size.

Plate 66.—*Agave Nelsoni.* Type (San Fernando, *Nelson & Goldman, 7111*), in the National Herbarium.

Plate 67.—*Agave Nelsoni.* 1, Details, from the type sheet. 2, Leaf-tip and flowers of the more oblong-leaved larger-flowered form (Onyx, *Nelson & Goldman, 7117*), in the National Herbarium.

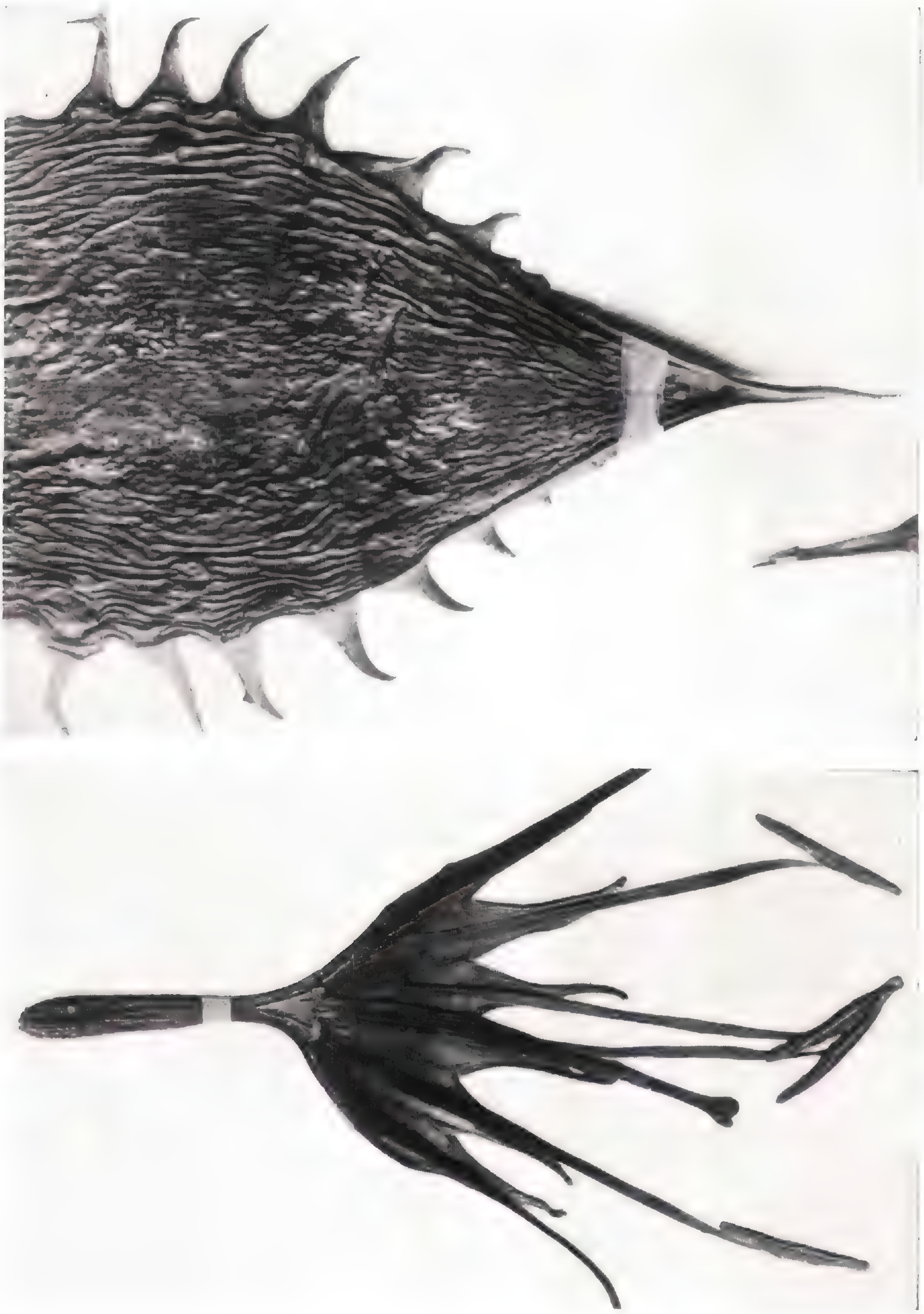
Plate 68.—*Agave Datylio.* 1, Leaves (La Paz, *Rose, 16540*), in the National Herbarium,—× 2/7. 2, Details, from the same sheet.

Plate 69.—*Agave Datylio.* 1, Pedicels and flowers (La Paz, *Brandegee*, 1899). 2, Flowers and, apparently undeveloped, capsules (San Pedro, *Brandegee, 581*). Both from the herbarium of the University of California.

Plate 70.—*Agave vexans.* Brandegee collections of 1889, in the University of California herbarium.

Plate 71.—*Agave vexans.* Details, from the preceding.

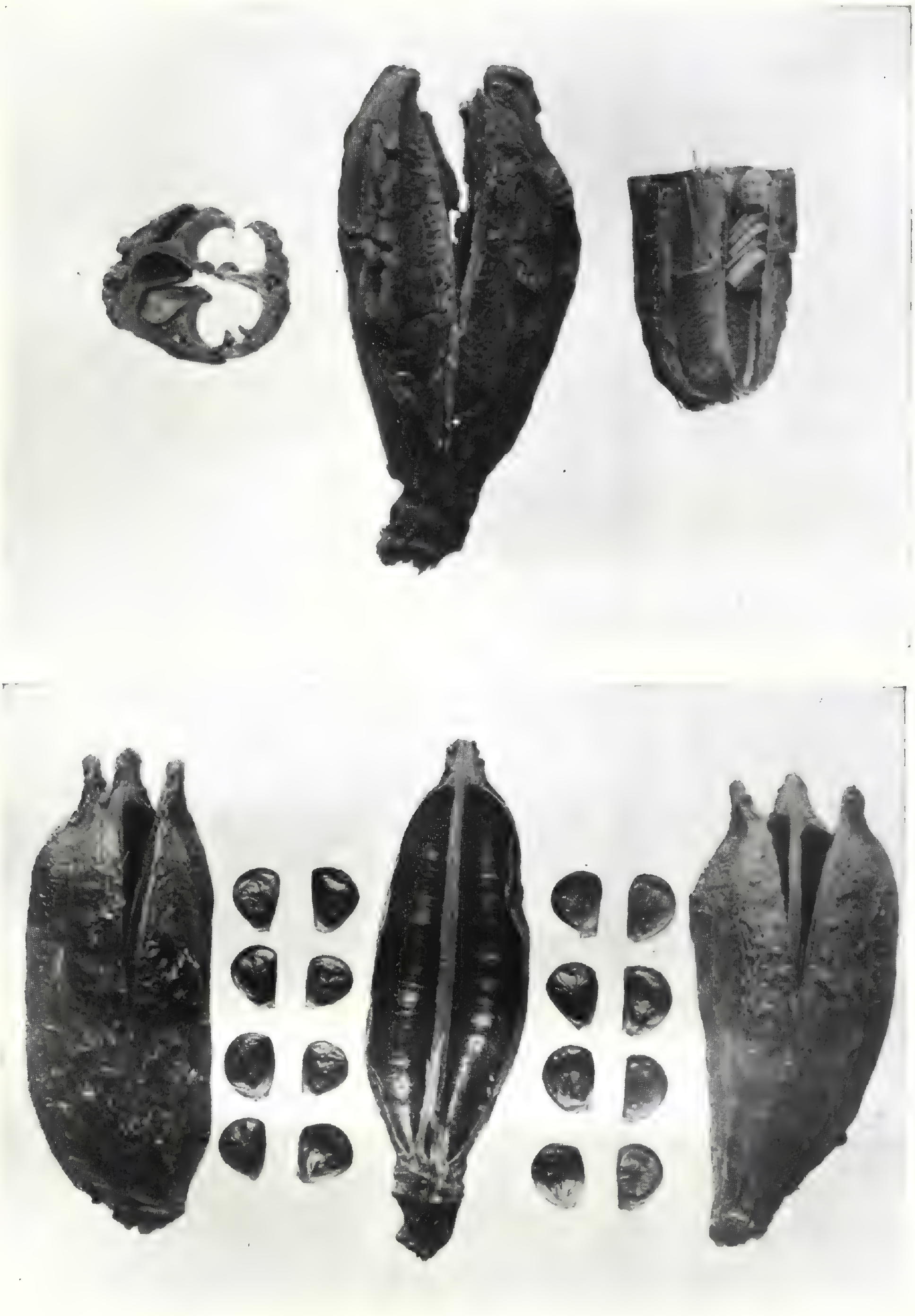
Plate 72.—*Agave vexans.* Details, from the type sheet, in the National Herbarium.



AGAVE SHAWII.

OPUNTIA GILVOALBA AND O. CYANELLA.

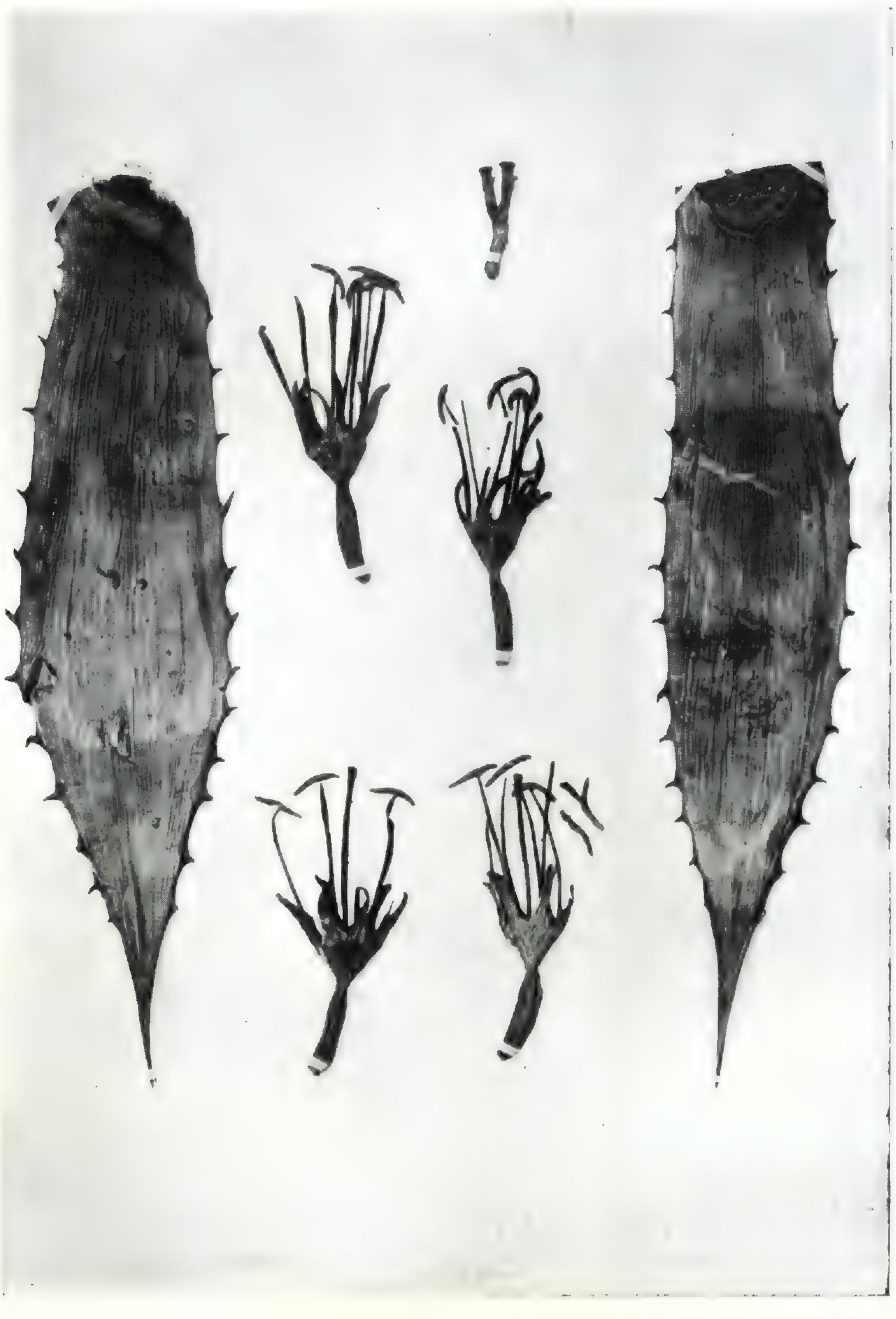
AGAVE SHAWII.



AGAVE SHAWII.

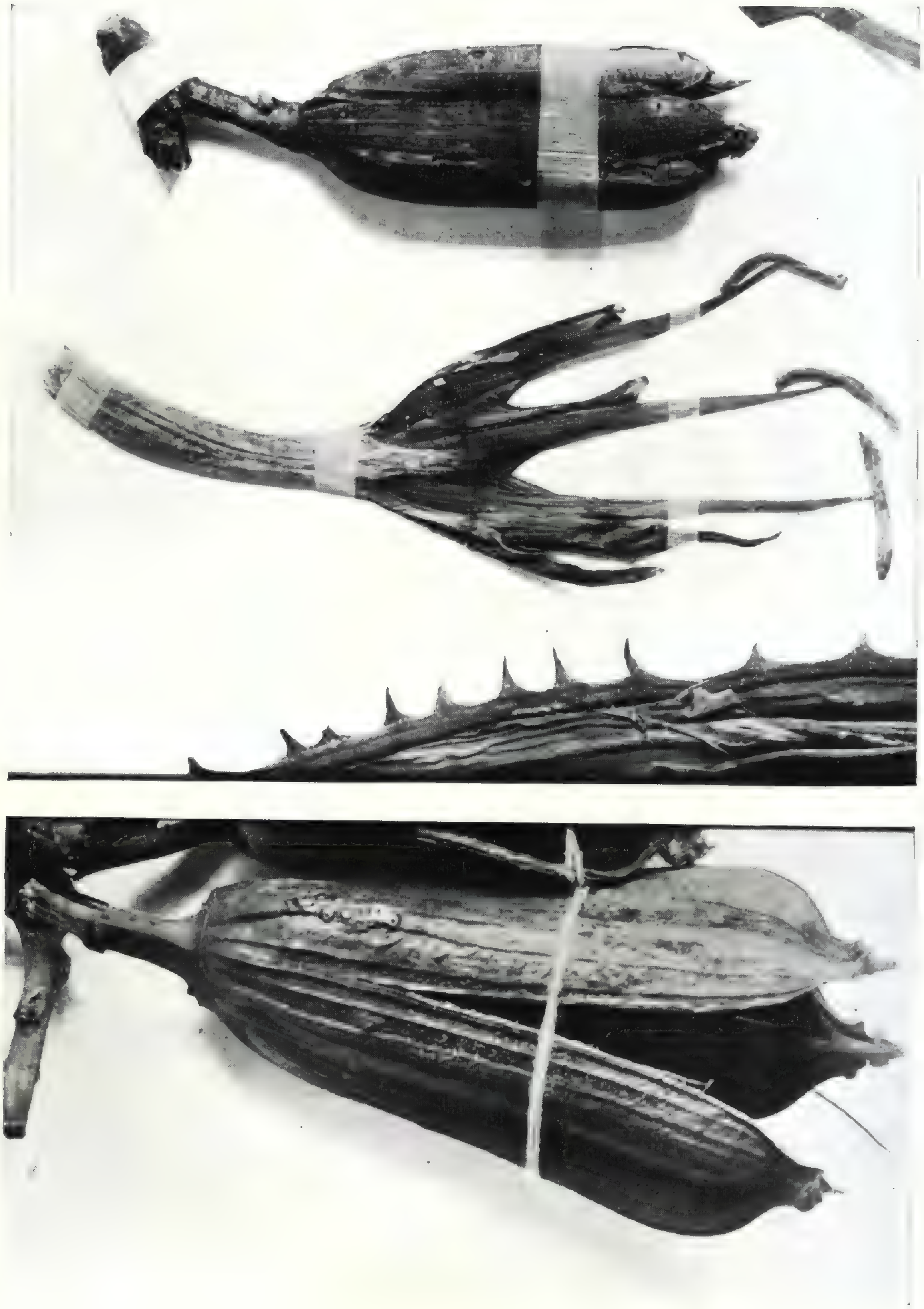
AGAVE ORCUTTIANA.

AGAVE SEBASTIANA.



AGAVE SEBASTIANA.

AGAVE SEBASTIANA.



AGAVE SEBASTIANA.

AGAVE PACHYACANTHA.

AGAVE PACHYACANTHA.

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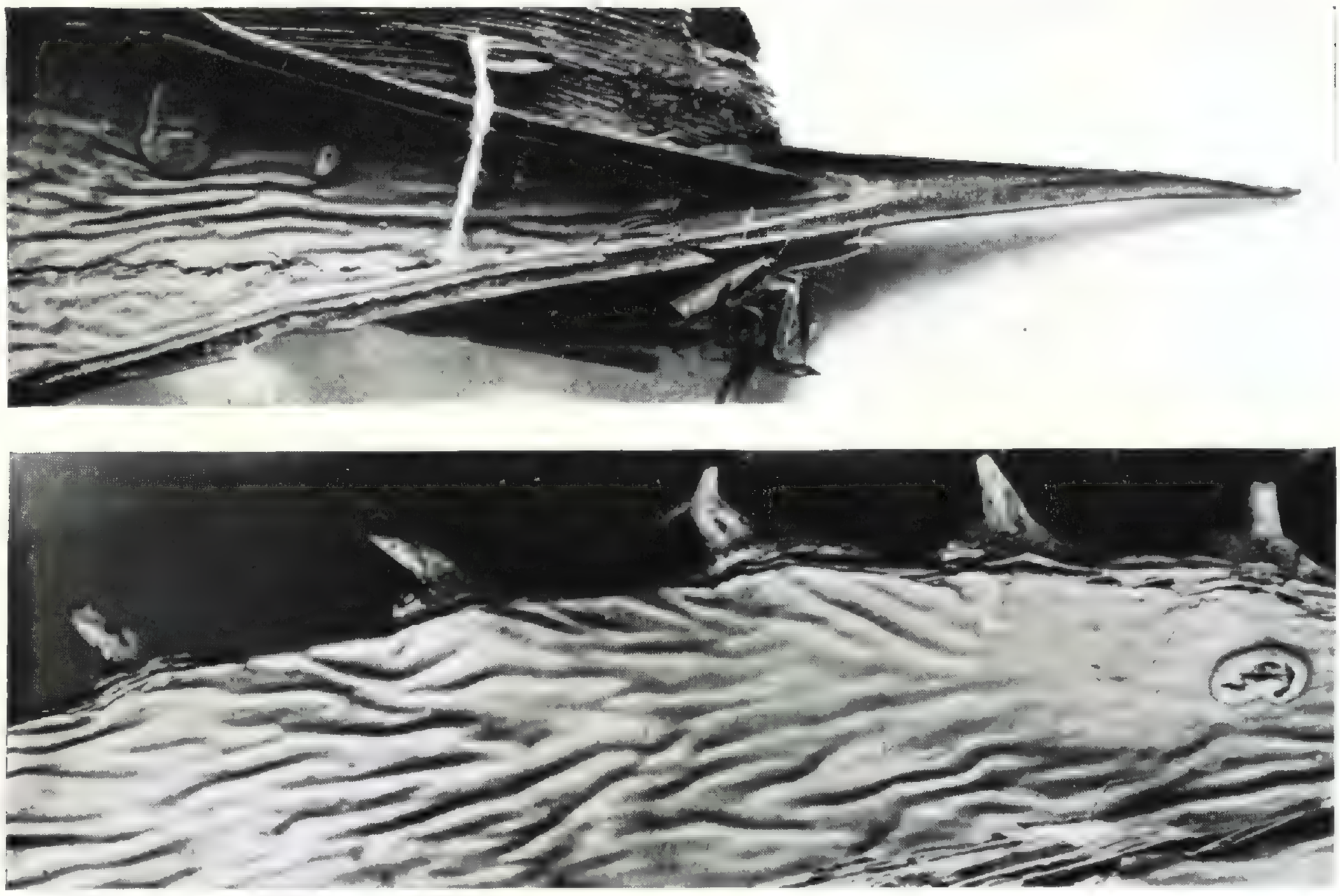
PHOTO. BY E. A. GOLDMAN.

AGAVE GOLDMANIANA.

AGAVE GOLDMANIANA.

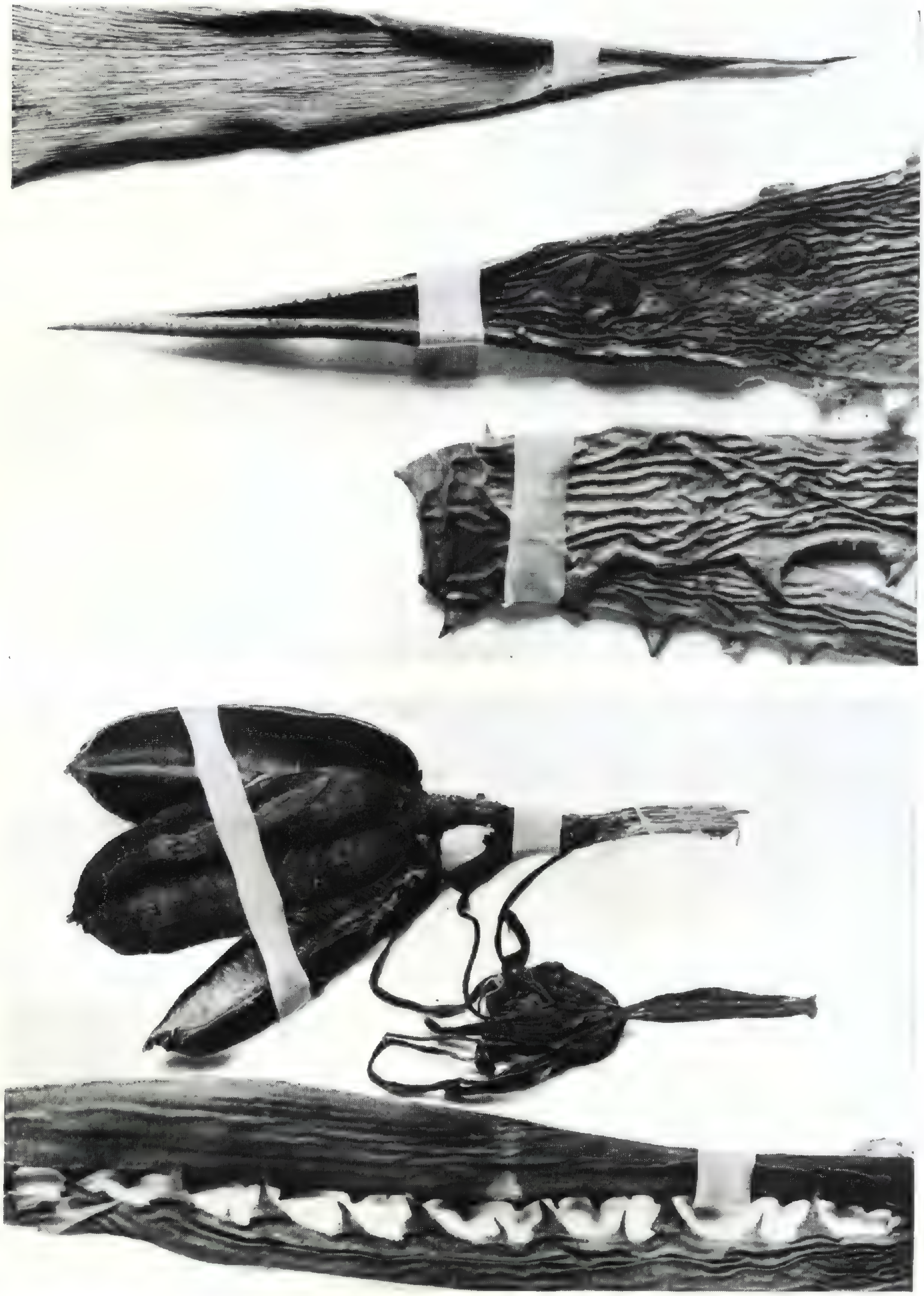


AGAVE GOLDMANIANA.

FLORA
OF
LOWER CALIFORNIA.
Agave aurea Brandegee
Purissima
Coll. Feb. 15th 1889.
T. S. BRANDEGEE

AGAVE AUREA.

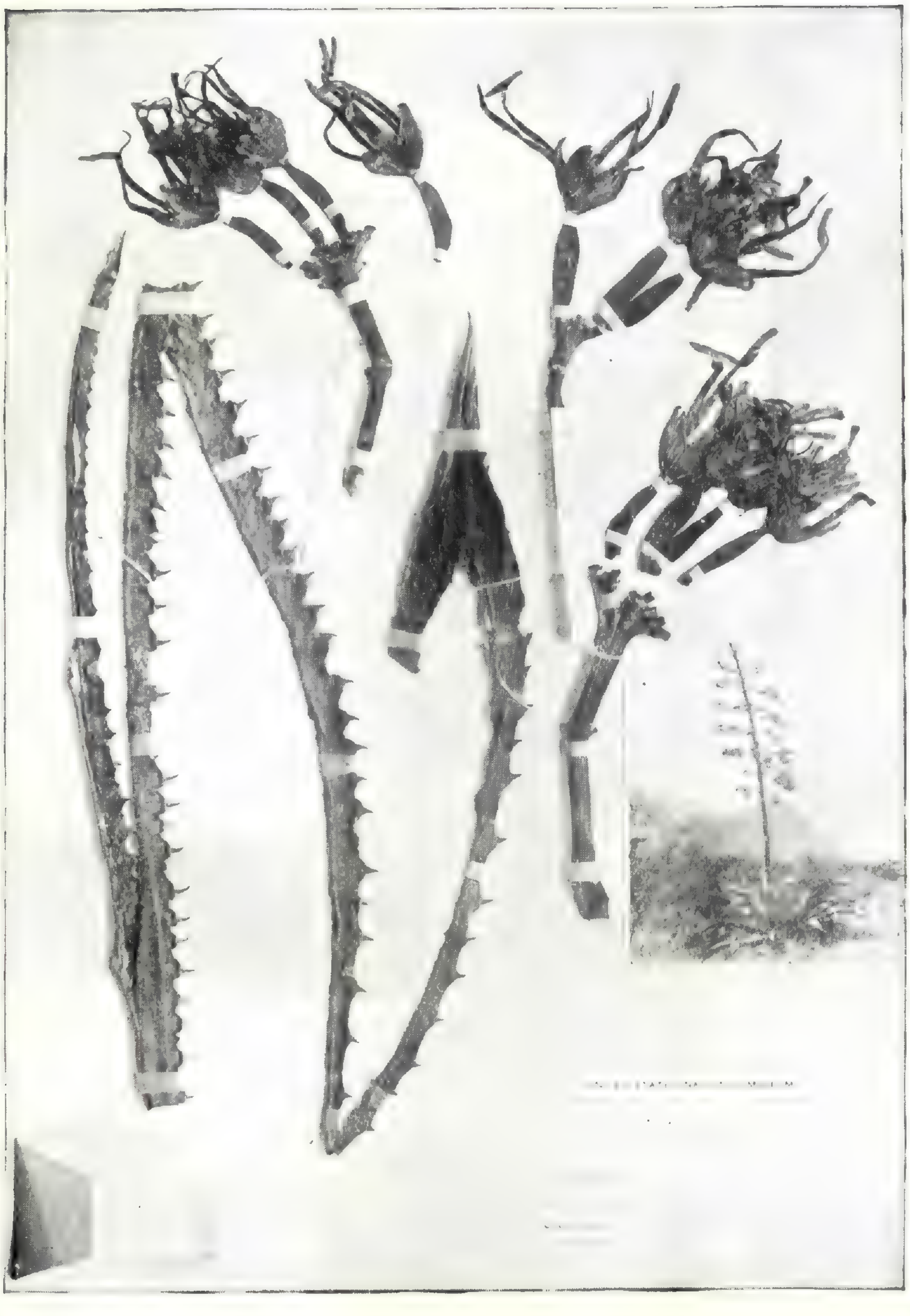
AGAVE AUREA.



AGAVE AUREA.

By Permission of Bureau of Biological Survey.
PHOTO. BY E. A. GOLDMAN.

AGAVE PROMONTORII.



AGAVE PROMONTORII.

AGAVE PROMONTORII.

AGAVE DENTIENS.

AGAVE DENTIENS.

AGAVE DENTIENS.

AGAVE DESERTI.

AGAVE DESERTI.

AGAVE CONSOCIATA.

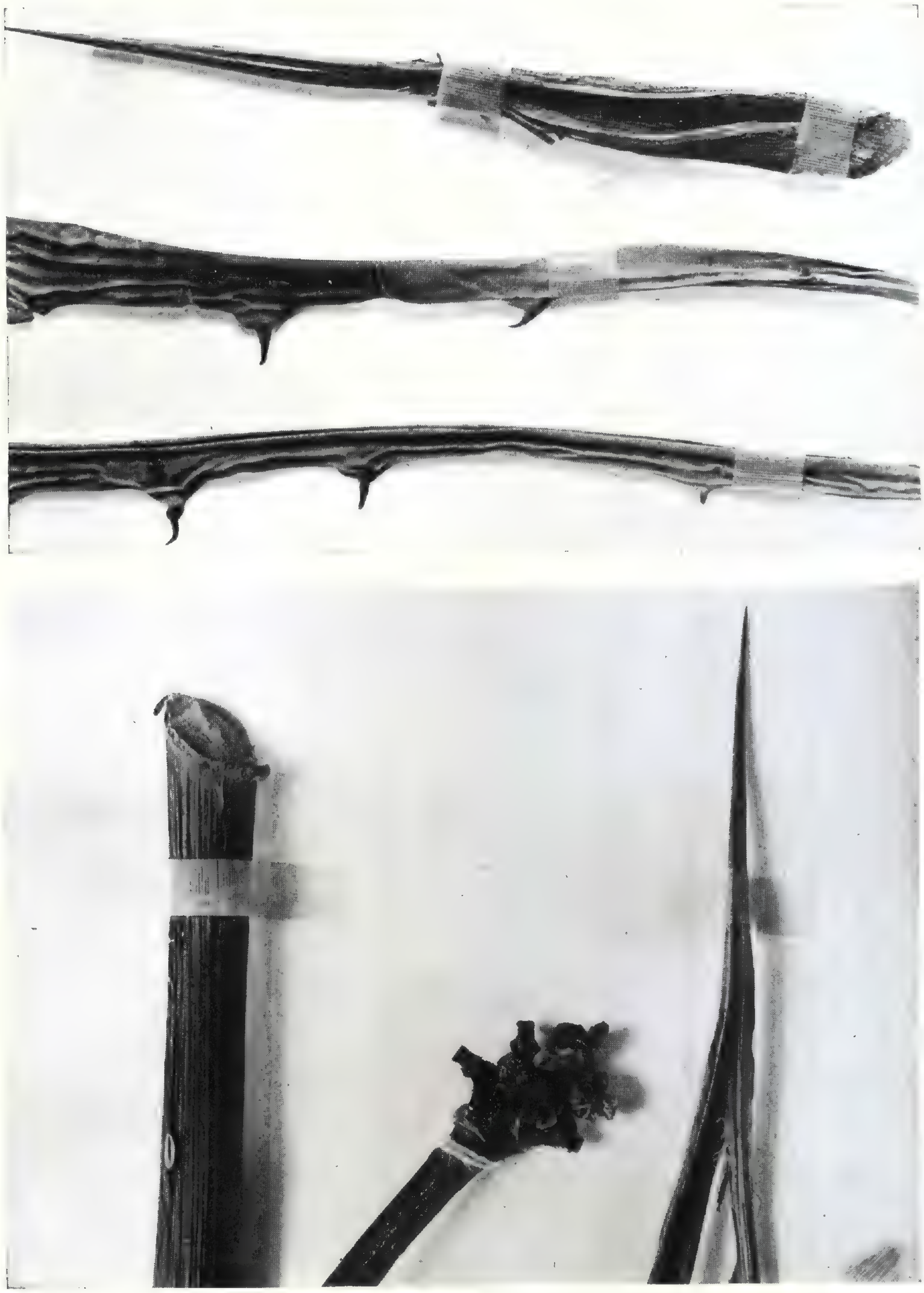
AGAVE PRINGLEI.

AGAVE CERULATA.

AGAVE CERULATA.

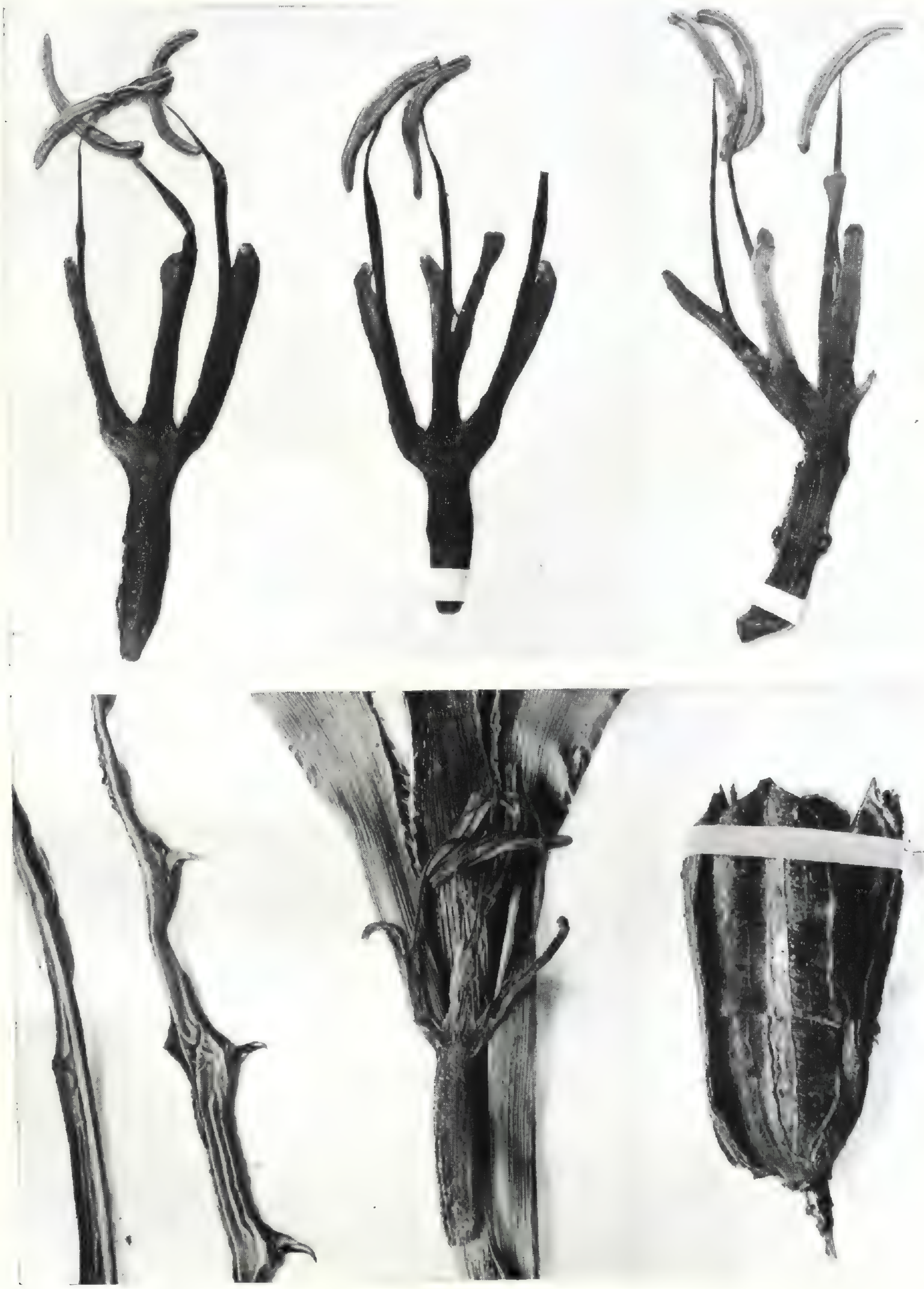
AGAVE CERULATA.

AGAVE CARMINIS.



AGAVE CARMINIS.

AGAVE SOBRIA.



AGAVE SOBRIA.

AGAVE AFFINIS.

AGAVE AFFINIS.

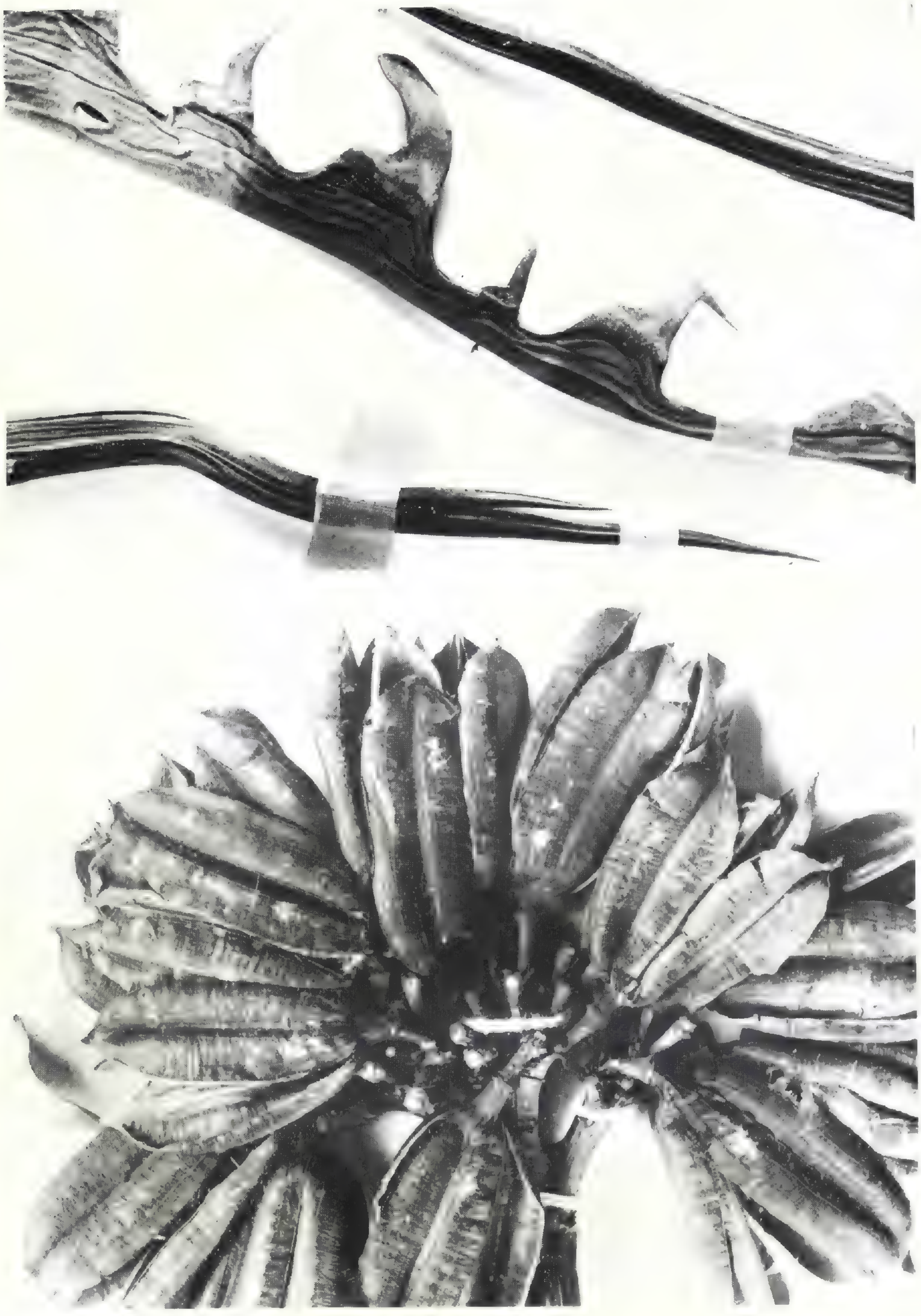
AGAVE BRANDEGEEI.

AGAVE MARGARITAE.

AGAVE MARGARITAE.

AGAVE CONNOCHAETODON.

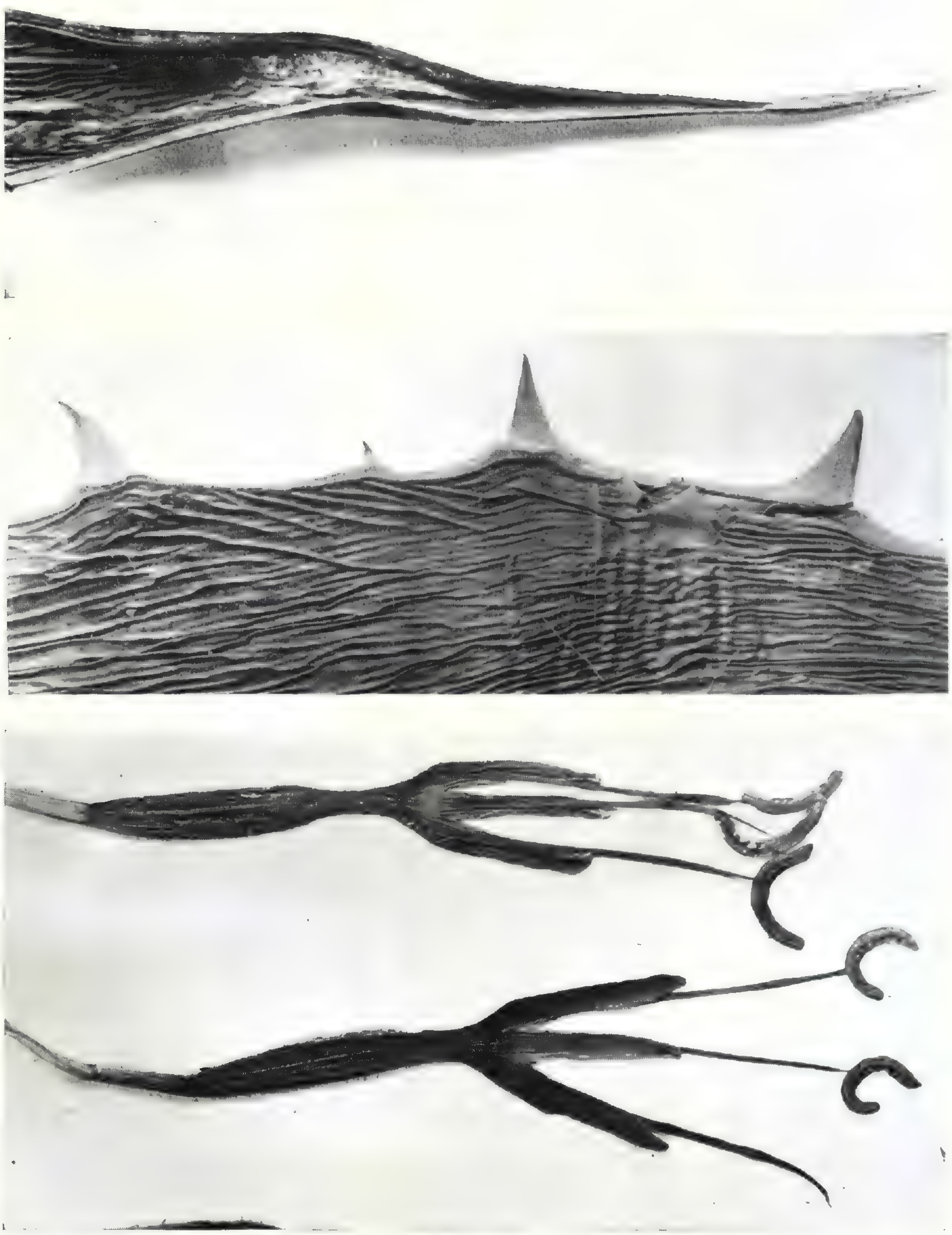
AGAVE ROSEANA.



AGAVE ROSEANA.

AGAVE ROSEANA.

AGAVE AVELLANIDENS.



AGAVE AVELLANIDENS.

AGAVE SUBSIMPLEX.

AGAVE SUBSIMPLEX.

AGAVE NELSONI.

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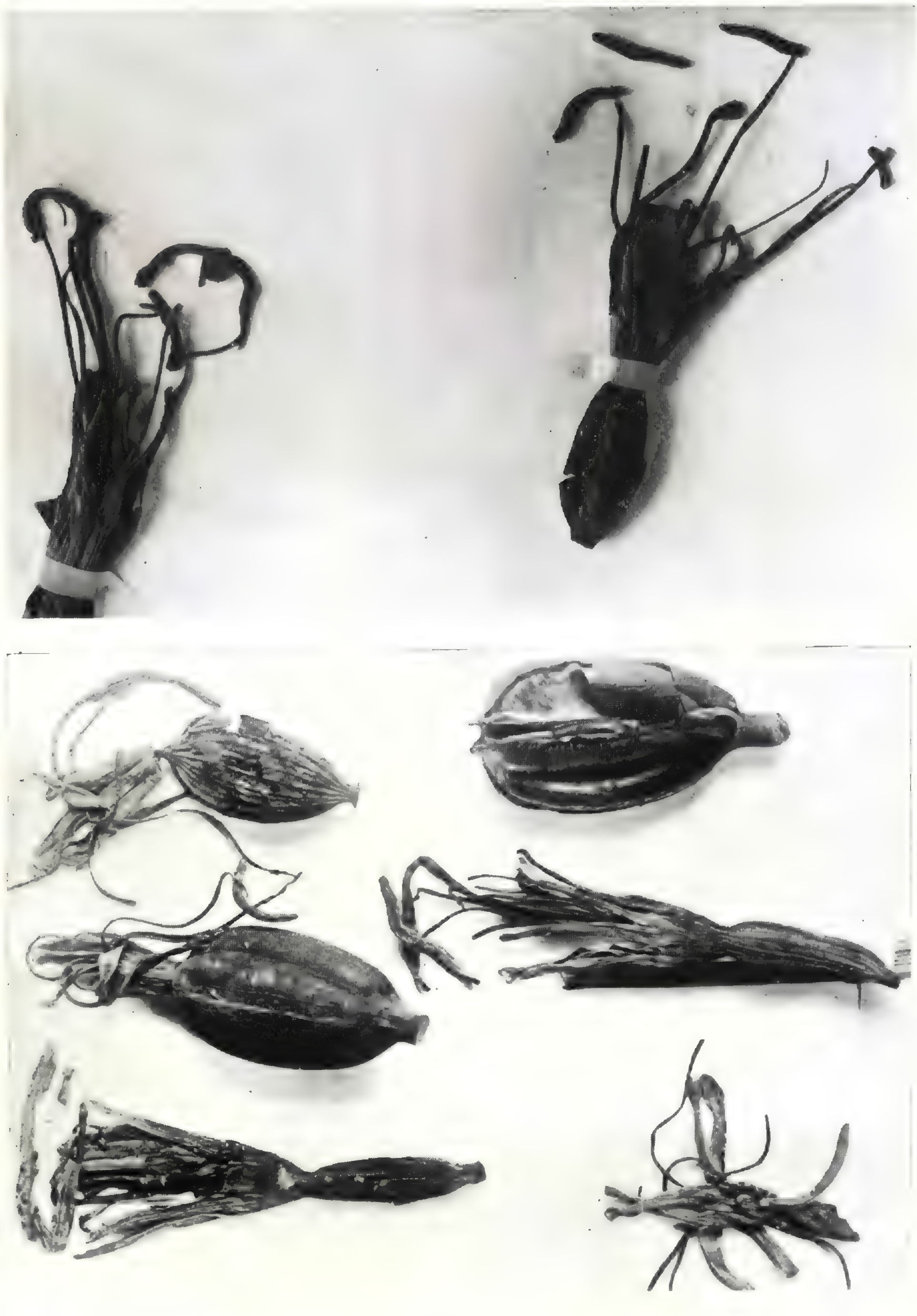
PHOTO. BY E. A. GOLDMAN.

AGAVE NELSONI.

AGAVE NELSONI.

AGAVE DATYLIO.



AGAVE DATYLIO.

AGAVE VEXANS.

AGAVE VEXANS.

CRATAEGUS IN MISSOURI.—II.

BY CHARLES SPRAGUE SARGENT.

Since the publication in the Nineteenth Report of the Garden of my paper on Crataegus in Missouri, in July, 1908, the genus has received further attention by Mr. E. J. Palmer, of Webb City, by Mr. B. F. Bush, who has found a few interesting species at Noel in Jasper County, and by Mr. E. J. Kellogg, who, in 1908, made large collections near Springfield. The Reverend John Davis, of Hannibal, a new collector in an entirely new field, has made known the presence of a number of interesting forms in the Viridis Group and has shown that plants of this Group extend further north than was suspected before Mr. Davis's investigations began.

A few of the recent discoveries are described in this paper which is far from completing the account of *Crataegus* found in Missouri. With the exception of the immediate neighborhood of Hannibal on the Mississippi River, all that part of the state which lies north of the Missouri River is still unexplored, and there are indications in the mass of incomplete material which has been sent to me that there are still a number of distinct and interesting species in the southern counties requiring further investigation.

CRUS-GALLI: stamens 10: anthers pink.

Crataegus calophylla, n. sp.

Glabrous with the exception of the hairs on young leaves. Leaves oblong-obovate, acute, apiculate or rarely rounded at the apex, gradually narrowed and cuneate at the entire base, finely glandular-serrate above the middle, with incurved or near the apex with straight teeth; tinged with red and furnished with occasional hairs on the upper side of the midribs when they unfold, nearly fully grown when the flowers open the first of May and then thin, glabrous, yellow-green above and paler below, and at maturity thin but firm, lustrous on the upper surface, dull on the lower surface, 5–6 cm. long and 2.5–3 cm. wide, with slender midribs, and thin primary veins partly within the parenchyma; petioles narrowly wing-margined to below the middle, 8–10 mm. in

length; leaves on vigorous shoots oval to slightly obovate, acuminate and abruptly short-pointed at the apex, cuneate at the base, coarsely serrate, often 7 cm. long and 3.5–4 cm. wide, their stipules linear, glandular-serrate, often falcate. Flowers 1.2–1.3 cm. in diameter, on long slender pedicels in wide compact mostly 12–20-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes long, slender, acuminate, entire, reflexed after anthesis; stamens 10; anthers pale pink; styles 1 or 2. Fruit ripening late in September, on long drooping stems, short-oblong or slightly ovate, rounded at the ends, orange-red marked by large dark dots, about 1 cm. long and 8–9 mm. wide; calyx prominent, with a short tube, a deep narrow cavity rounded in the bottom, and reflexed lobes; flesh thin, dry and mealy; nutlet 1, slightly narrowed and rounded at the ends, slightly and irregularly ridged, 7–8 mm. long and 5 mm. in diameter, or when 2 about 3 mm. wide, the narrow hypostyle extending to below the middle of the nutlets.

A tree sometimes 7 or 8 m. high, with a tall trunk 15-18 cm. in diameter, covered with rough gray bark, spreading branches forming a wide round-topped head, and slender zigzag branchlets dark orange-green when they first appear, becoming light orange-brown at the end of their first season and dull gray-brown the following year, and armed with numerous stout nearly straight chestnut brown spines 5-9 cm. long, persistent and becoming branched on old stems.

Near Springfield, Greene County (*J. H. Kellogg, 123,* type, May 3 and September 19, 1908; *122,* May 2 and September 24, 1908; *122,* with 10-14 stamens, May 2 and September 24, 1908).

CRUS-GALLI: stamens 10: anthers yellow or white.

Crataegus paradoxa, n. sp.

Leaves oblong-obovate, acute, acuminate, or rarely rounded at the apex, gradually narrowed and concave-cuneate at the entire base, and finely often doubly serrate above with straight or incurved glandular teeth, nearly fully grown when the flowers open in the first week of May and then thin, covered above by short white hairs and villose on the midribs and veins below, and at maturity thick, yellow-green, lustrous and glabrous on the upper surface, paler on the lower surface, and still villose on the prominent midribs and slender primary veins, 3.5–4 cm. long and 1.5–2 cm. wide; petioles slender, slightly wing-margined at the apex, densely villose early in the season, becoming sparingly villose or nearly glabrous before autumn, 8–12 mm. in length;

leaves on vigorous shoots oval to slightly obovate, abruptly acuminate at the apex, cuneate at the base, foliaceous, coarsely serrate, 5–6 cm. long and 3–4 cm. wide. Flowers 2 cm. in diameter, on long slender slightly villose pedicels in mostly 8–12-flowered glabrous or slightly hairy corymbs, the long lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes long, slender, acuminate, entire or minutely dentate near the base, glabrous, reflexed after anthesis; stamens 10; anthers yellow; styles 2 or 3. Fruit ripening in October, on slender glabrous pedicels, in drooping clusters, ovoid, narrowed and rounded at the ends, red marked by occasional dark dots, 8–10 mm. long and 6–7 mm. wide; calyx prominent, with a shallow cavity, and coarsely spreading persistent lobes; flesh thin, dry and mealy; nutlets 2 or 3, usually 2, rounded at the ends, rounded and ridged on the back with a low broad ridge, about 6 mm. long and 3–3.5 mm. wide, the broad hypostyle extending to the middle of the nutlet.

An arborescent shrub 2-3 m. high, with stems covered with dark gray scaly bark, stout ascending branches and thick zigzag branchlets light orange-green and loosely covered with long white hairs when they first appear, still villose or nearly glabrous, dark red-brown and marked by pale lenticels at the end of their first season and dull red-brown the following year, and armed with a few stout straight spines 3-4 cm. in length.

Upland thickets in dry limestone barrens or in low moist soil near the banks of small streams. Joplin, Joplin County (*E. J. Palmer, 11,* type, May 8 and September 27, 1908; *11A,* September 27, 1908); Webb City, Joplin County (*E. J. Palmer, 45, 45A, 45B,* May and September, 1909).

From all the other Crus-galli species with 10 stamens and yellow anthers of southern Missouri, where these species abound, *Crataegus paradoxa* differs in the presence of hairs on the leaves, corymbs and young branches. From *Crataegus Palmeri* Sargent, which is common in the same region and is entirely glabrous, it differs also in the shape of the leaves, especially those on vigorous shoots; these are pointed and without lobes, while those of *Crataegus Palmeri* are usually broad at the apex and often lobed. It differs, too, from that species in its longer ovoid, not subglobose or short-oblong, fruits.

Crataegus Parkae, n. sp.

Glabrous with the exception of the hairs on the young leaves. Leaves oblong-obovate to lanceolate, acuminate or rounded and apiculate at the apex, gradually narrowed to the slender cuneate entire base, and finely serrate above the middle, with straight glandular teeth; nearly fully grown when the flowers open during the first week in May and then thin, villose along the upper side of the midribs, light yellow-green and lustrous above and pale below, and at maturity thin, dark yellow-green on the upper surface, pale on the lower surface, 4.5–5.5 cm. long and 2–2.5 cm. wide, with slender midribs, and thin primary veins partly within the parenchyma; petioles slender, slightly wing-margined at the apex, about 1 cm. in length; leaves on vigorous shoots broadly obovate, acuminate or rounded and apiculate at the apex, cuneate at the base, coarsely serrate, often 5–6 cm. long and 3–4 cm. wide, with stout midribs and prominent primary veins. Flowers 1–1.2 mm. in diameter, on long slender pedicels, in small compact mostly 12–15-flowered corymbs, their lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes abruptly narrowed from wide bases, long, slender, acuminate, entire, reflexed after anthesis; stamens 10; anthers white; styles 2. Fruit ripening the end of September, on slender pedicels, in large drooping clusters, oblong-ovate, rounded at the base, gradually narrowed and rounded at the apex, red, marked by large pale dots, 1–1.2 cm. long and 8–9 mm. wide; calyx small, with a short tube, a very narrow cavity pointed in the bottom, and spreading lobes, their tips usually deciduous from the ripe fruit; flesh thin, dry and mealy; nutlets 2, rounded at the base, pointed at the apex, irregularly ridged on the back, with a high narrow ridge, about 8 mm. long and 3.5 mm. wide.

A tree 7 or 8 m. high, with a tall trunk sometimes 3 dm. in diameter, covered with rough scaly dark bark, a wide round-topped head, and slender nearly straight branchlets dark orange-green and marked by pale lenticels when they first appear, becoming dull light orange or reddish brown at the end of their first season and darker-colored the following year, and armed with few slender straight chestnut brown spines 1.5-3 cm. long.

Near Springfield, Greene County (*J. H. Kellogg, 129,* type, May 9 and September 23, 1908; *121,* May 3 and September 25, 1908; *127* and *128,* with anthers described as yellow).

This plant seems distinct in the remarkably small calyx of the fruit with an unusually narrow cavity, and in the

small spines which are much less numerous than those of most species of the Crus-galli Group; and it is a pleasure to associate it with the name of Miss E. J. Park, assistant librarian of Drury College at Springfield, who at different times has sent me specimens with important notes on some of the thorns which grow in the vicinity of Springfield.

CRUS-GALLI: stamens 15–20: anthers white.

Crataegus effulgens, n. sp.

Leaves oblong-obovate, acute, acuminate and rounded at the apex, gradually narrowed to the long cuneate entire base and finely serrate above, with straight glandular teeth; nearly fully grown when the flowers open in the first week of May and then yellow and lustrous above and pale below, and at maturity thin but firm, very lustrous, 5–5.5 cm. long and 2.5–3 cm. wide, with thin prominent midribs and primary veins; petioles slender, narrowly wing-margined nearly to the middle, 1–1.5 cm. in length; leaves on vigorous shoots oval to obovate, short-pointed at the apex, cuneate at the base, more coarsely serrate, often 5.5–6 cm. long and 4–4.5 cm. wide, with short stout petioles and thick midribs, their stipules foliaceous, obovate-falcate, glandular-serrate, deciduous. Flowers 1.5 cm. in diameter, on long slender pedicels, in wide mostly 12–16-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes slightly narrowed from wide bases, acuminate, entire, reflexed after anthesis; stamens 15 or 16; anthers white; styles 2, surrounded at the base by a ring of long white hairs. Fruit ripening at the end of September, on long slender drooping stalks, short-oblong, rounded at the ends, scarlet, lustrous, marked by large pale dots, 1.2–1.4 cm. long and 1–1.2 cm. wide; calyx little enlarged, with a broad deep cavity rounded in the bottom, and closely appressed lobes; flesh thin, dry and mealy; nutlets 2, rounded at the ends, broader at the apex than at the base, rounded and slightly ridged on the back, 7–8 mm. long and about 4 mm. wide.

A shrub with small stems sometimes 10 cm. in diameter forming large clumps, and slender branchlets dark orange-brown when they first appear, becoming reddish brown and lustrous at the end of their first season and dull gray-brown the following year, and armed with numerous slender straight or slightly curved chestnut brown spines, 3.5-10 cm. long and persistent on the old stems.

Brookline, Greene County (*J. H. Kellogg, 125,* type, May 7 and September 24, 1908).

Crataegus polyclada, n. sp.

Glabrous with the exception of the hairs on the young leaves. Leaves oblong-obovate, rounded and apiculate at the apex, gradually narrowed to the concave-cuneate entire base, and finely crenately serrate above the middle, with gland-tipped teeth; deeply tinged with red and slightly hairy along the upper sides of the midribs when they unfold, nearly fully grown when the flowers open the first of May and then thin, yellow-green, glabrous and lustrous on the upper surface, dull and rather paler on the lower surface, and at maturity thin but firm in texture, yellow-green and lustrous above, dull below, 5–6 cm. long and 2.5–3 cm. wide, with prominent but thin midribs and primary veins; petioles slender, narrowly wing-margined nearly to the middle, sparingly glandular early in the season, 8–10 mm. in length; leaves on vigorous shoots oval to slightly obovate, acuminate or rounded at the apex, cuneate at the base, 5–6 cm. long and about 3 cm. wide. Flowers 1.2–1.4 cm. in diameter, on long slender pedicels, in compact mostly 12–20-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes separated by wide sinuses, narrow, acuminate, entire or minutely dentate near the middle, reflexed after anthesis; stamens 20; anthers white; styles 2. Fruit ripening at the end of September, on slender pedicels, in drooping clusters, short-oblong, sometimes slightly ovate, rounded at the ends, orange-red, marked by numerous large pale dots, about 1.2 cm. long and 1 cm. wide; calyx little enlarged, with a narrow deep cavity rounded in the bottom, and spreading closely appressed persistent lobes; flesh thin, dry and mealy; nutlets 2, rounded at the ends, rounded and only slightly ridged on the back, about 8 mm. long and 3.5 mm. wide.

A tree with a tall trunk sometimes 2.5 dm. in diameter, covered with rough scaly gray bark, large wide-spreading branches forming a round head, and slender slightly zigzag branchlets light orange-green and marked by numerous large pale lenticels when they first appear, becoming orange or reddish brown and lustrous by the end of their first season and dull gray-brown the following year, and armed with numerous slender nearly straight chestnut brown shining spines 5-5.5 cm. long, long-persistent and becoming forked on old trunks.

Near Springfield, Greene County (*J. H. Kellogg, 119,* type, May 1 and September 25, 1908).

PUNCTATAE.

Crataegus latebrosa, n. sp.

Leaves oval to ovate or rarely slightly obovate, acuminate or short-pointed at the apex, abruptly cuneate or rounded at the base, sharply often doubly serrate, and only occasionally slightly and irregularly lobed above the middle; when they unfold thickly covered on the upper surface with short white hairs and on the lower surface with hoary tomentum, more than half-grown when the flowers open in the third week of April and then thin, yellow-green and roughened above by short white hairs, and villose below especially on the midribs and veins, and at maturity thin, yellow-green, lustrous and smooth on the upper surface, villose on the lower surface, 5–6 cm. long and 3.5–3.8 cm. wide, with prominent midribs and primary veins; petioles slender, slightly wing-margined at the apex, coated early in the season with long scattered white hairs, later becoming sparingly hairy, 1.3–1.5 cm. in length; leaves on vigorous shoots acuminate, rounded or slightly cordate at the broad base, often 6–7 cm. long and 4–5 cm. wide, with thick prominent midribs and veins. Flowers 2 cm. in diameter, on short slender densely villose pedicels, in compact mostly 6–12-flowered corymbs, their bracts and bractlets linear, scarious, glandular, often persistent until the petals fall, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, thickly clothed with white hairs, the lobes separated by wide sinuses, acuminate, glandular-serrate, with bright red glands, villose; stamens 10; anthers yellow; styles 3–5. Fruit (gathered in August and probably not fully grown) on erect slender villose pedicels, in few-fruited clusters, short-oblong, rounded at the apex, slightly narrowed at the base, pubescent at the ends, 1 cm. in diameter; calyx little enlarged, with a wide shallow cavity and closely appressed villose lobes; flesh thin; nutlets 3–5, rounded at the ends, thicker at the apex than at the base, rounded and slightly ridged on the back, about 7 mm. long and 4 mm. wide, the narrow hypostyle prominent and extending to below the middle of the nutlets.

Woods, Noel, Joplin County (*B. F. Bush, 1,* type, August 7, 1908, April 24, 1909).

I have no notes on the habit, size, character of the bark, etc., of this plant which is readily distinguished by the shape of the leaves and by the small compact corymbs from the other species of Punctatae which are such an interesting feature of the Crataegus flora of southern Missouri.

The branchlets are stout, nearly straight, coated when they first appear with long matted hairs, becoming light

chestnut brown and pubescent in their first season and dark reddish brown and nearly glabrous the following year. Mr. Bush's specimens are without thorns.

Crataegus glabrifolia, n. sp.

Leaves rhombic to obovate, acute or acuminate, gradually narrowed to the cuneate entire base, finely often doubly serrate above, with straight glandular teeth, and irregularly divided above the middle into 2 or 3 pairs of short broad lobes; more than half-grown when the flowers open about the 1st of May and then thin, light yellow-green, lustrous and furnished with a few pale hairs above, paler and glabrous below, and at maturity thin, yellow-green, glabrous, 4–4.5 cm. long and 2.3–3 cm. wide, with slender prominent midribs, and 5 or 6 pairs of thin primary veins; petioles slender, narrowly wing-margined at the apex, slightly hairy on the upper side early in the season, soon glabrous, sparingly glandular, 1–1.3 cm. in length; leaves on vigorous shoots ovate, acuminate, cuneate at the base, deeply divided above the middle into acuminate lobes, often 5–6 cm. long and 4.5–5 cm. wide, with more prominent midribs and veins. Flowers small, on short pedicels, glabrous or furnished with occasional white hairs, in crowded mostly 5–7-flowered corymbs; calyx-tube narrowly obconic, glabrous, gradually narrowed from the broad base, acuminate, slightly glandular, glabrous on the outer surface, villose on the inner surface, with a few short hairs, reflexed after anthesis; stamens 10; color of the anthers unknown; styles 3–5. Fruit ripening in October, on short erect pedicels, in few-fruited clusters, subglobose, angular, greenish red marked by numerous small dark dots; flesh dry and mealy; calyx little enlarged, with a deep narrow cavity pointed in the bottom, and appressed lobes; flesh thin; nutlets 3–5, rounded at the ends, wider at the apex than at the base, rounded and ridged on the back, with a broad high grooved ridge, 5–7 mm. long and 3–4 mm. wide.

Grandin, Carter County (*B. F. Bush, 9,* type, May 6 and October 10, 1905; *9A,* May 7 and October 11, 1905).

This species differs so greatly from the other Punctatae of southern Missouri in the shape of the leaves, in the short pedicels and almost entire absence of any hairy covering on the leaves and calyx that I have ventured to describe it, although the color of the anthers is unknown and I am without information as to the size and habit of the plants. Herbarium specimens show that the branchlets are glabrous and that the thorns are numerous, slender, nearly straight, chestnut brown, lustrous and 3.5-6 cm. in length.

VIRIDES: anthers yellow.

Crataegus lutensis, n. sp.

Glabrous with the exception of the hairs on the young petioles and in the axillary tufts. Leaves obovate or rarely oval or ovate, acuminate and long-pointed at the apex, gradually narrowed and cuneate at the base, doubly serrate above, with straight or incurved glandular teeth, and mostly 3-lobed at the apex or above the middle; nearly fully grown when the flowers open early in May, and at maturity thin, dark yellow-green and lustrous on the upper surface, dull green and furnished below with small tufts of axillary hairs, 4–5 cm. long and 3–4 cm. wide, with thin midribs, and slender veins extending to the points of the lobes; petioles slender, slightly wing-margined at the apex, covered on the upper side when they first appear with long pale hairs, becoming glabrous, 1.5–2 cm. in length; leaves on vigorous shoots ovate, acuminate, abruptly cuneate or occasionally rounded at the broad base, coarsely serrate, deeply divided into wide acuminate lobes, often 6–7 cm. long and 6 cm. wide, with prominent midribs and primary veins. Flowers 1.5 cm. in diameter, on slender pedicels, in mostly 10–15-flowered corymbs, their lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes long, slender, acuminate, entire, reflexed after anthesis; stamens 20; anthers yellow; styles 3–5, surrounded at the base by a narrow ring of pale hairs. Fruit ripening in October, on long drooping stalks, in few-fruited clusters, short-oblong, rounded at the ends, orange-red, marked by small dark dots, about 6 mm. long and 4.5 mm. wide; calyx enlarged and prominent, with a wide deep cavity, and closely appressed lobes; flesh thin, yellow, dry and mealy; nutlets 3–5, rounded at the apex, narrowed at the base, slightly grooved on the back, 3.5 mm. long and 2.5 mm. wide.

A tree sometimes 4 m. high, with a slender trunk, small ascending branches and slender slightly zigzag branchlets dark orange-green when they first appear, becoming dull red-brown and marked by pale lenticels in their first season and dull gray-brown the following year, and unarmed or occasionally furnished with straight slender chestnut brown spines 3.5-4 cm. long.

In low wet bottom-lands of Shoal Creek, Reading's Mill, Newton County, common (*E. J. Palmer, 37*, type, September 26 and 30, 1908, May 8, 1909).

To be distinguished from *C. viridis* Linnaeus by the shape of the thinner leaves, especially those of vigorous shoots, and by the short-oblong fruits.

Crataegus nitens, n. sp.

Leaves broadly ovate, acute or acuminate, cuneate or rounded at the wide entire base, and coarsely serrate, with straight or incurved glandular teeth; nearly fully grown when the flowers open about the middle of May and then yellow-green and glabrous with the exception of a few pale hairs on the upper side of the midribs and in the axils of the veins below, and at maturity thin, glabrous, yellow-green and very lustrous on the upper surface, paler and dull on the lower surface, 3–4 cm. long and 2–2.5 cm. wide, with slender midribs, and usually four pairs of thin primary veins; petioles slender, wing-margined sometimes nearly to the middle, covered on the upper side with long white hairs, becoming glabrous, more or less tinged with red in the autumn, 1–1.5 cm. in length; leaves on vigorous shoots ovate, acuminate, rounded or abruptly cuneate at the broad base, more coarsely serrate, slightly lobed, 4–5 cm. long and 3.5–4 cm. wide. Flowers 1.2 cm. in diameter, on slender glabrous pedicels, in 10–14-flowered corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, the lobes gradually narrowed from wide bases, short, entire, glabrous, reflexed after anthesis; stamens 20; anthers cream color; styles 3–5. Fruit ripening in October, on slender spreading pedicels, subglobose, orange red, lustrous, 6–8 mm. in diameter; calyx prominent, with a short tube, a wide shallow cavity, and spreading appressed lobes; flesh thin, dry and mealy; nutlets 3–5, usually 3, rounded at the ends, rounded on the back, 5 mm. long and about 2.5 mm. wide.

A tree often 7-8 m. high, with a trunk sometimes 3 dm. in diameter, covered with smooth gray bark, and wide-spreading branches forming a symmetrical round-topped head, and slender nearly straight branchlets light orange-green and glabrous when they first appear, becoming bright chestnut brown and lustrous in their first season and dull gray-brown the following year, and armed with occasional slender straight spines 1.5-2 cm. in length.

In rich soil on rolling rocky hills above the bluffs of the Mississippi River, near Hannibal, Marion County (*J. Davis, 61,* type, May 14, 1909, October 6, 1911).

From *Crataegus viridis* Linnaeus, which grows on the bottom-lands of the Mississippi River in Illinois, *Crataegus nitens* differs in the shape of the short broadly ovate short-pointed thicker and lustrous leaves, and in the darker color of the branches. It differs, too, in growing on high hills and not on bottom-lands.

VIRIDES: anthers pink.

Crataegus Davisii, n. sp.

Leaves ovate to oval, acute or acuminate, gradually narrowed and concave-cuneate at the entire base, sharply often doubly serrate above, with straight or incurved glandular teeth, and sometimes slightly divided above the middle into short broad lobes; when the flowers open, from the 15th to the 20th of May, glabrous with the exception of a few hairs along the upper side of the midribs and in the axils of the veins below, and at maturity thin, glabrous, yellow-green, lustrous on the upper surface, dull and paler on the lower surface, 4–5.5 cm. long and 2.5–3.5 cm. wide, with slender midribs and five or six pairs of thin primary veins; petioles slender, slightly wing-margined at the apex, sparingly villose while young, becoming glabrous, dark red especially on the lower side in the autumn, 1.8–2.4 cm. in length; leaves on vigorous shoots ovate, acute or abruptly acuminate, cuneate at the broad base, coarsely serrate, slightly, or often deeply and irregularly lobed by narrow sinuses sometimes extending nearly to the midrib, with stouter petioles widely wing-margined toward the apex and 2–3.5 cm. long, and lunate, coarsely serrate persistent stipules. Flowers 1.5–1.7 cm. in diameter, on long slender glabrous pedicels, in few-flowered corymbs; calyx-tube narrowly obconic, the lobes slender, acuminate, entire or occasionally provided with a few minute teeth, glabrous, reflexed after anthesis; stamens 15–20; anthers pink; styles 5. Fruit ripening in October and persistent during the winter, on erect or spreading pedicels, subglobose, often rather broader than high, crimson, 7 or 8 mm. in diameter; calyx-tube broad and shallow, the lobes deciduous from the ripe fruit; flesh thin, rather succulent; nutlets 5, thin, rounded at the ends and on the back, 4–5 mm. long and about 2 mm. wide.

A bushy tree 7 or 8 m. high, with a trunk often 18-20 cm. in diameter, covered with thin smooth pale gray bark exfoliating in large plates, small spreading branches forming a broad round-topped head, sometimes 10 m. in diameter, and slender nearly straight branchlets slightly villose when they first appear, soon glabrous, dark orange-brown, lustrous and marked by many small pale lenticels at the end of their first season, usually unarmed or occasionally furnished with slender straight spines 5-6.5 cm. long.

In rich soil on high rolling rocky hillsides above the bluffs of the Mississippi River, north of Hannibal, Marion County (*John Davis, 99,* type, Riverview Park, May 20,

1909, October 11, 1911; *95,* also numbers *81, 82, 91, 95, 96, 97, 98, 100,* May, 1909); Clarksville, Pike County (*John Davis, 63,* May 15, 1909; *64,* May 16, 1909, September 3, 1911).

I am glad to associate the name of the Reverend John Davis of Hannibal with this plant for he is a zealous student of Crataegus and the other trees of northeastern Missouri, a region which as well as the rest of the state north of the Missouri River has been strangely neglected by botanists. Previously described species of the Viridis Group, with the exception of *Crataegus furcata* Sargent from southwestern Missouri, grow on bottom-lands often inundated during part of the year, and species with rose-colored or pink anthers are extremely rare, only three having been described. Of these, two are from southeastern Tennessee and the other from the swamps of the Red River near Fulton, Arkansas. Mr. Davis's discovery of this species and two others of this group growing on high ground at least one hundred miles north of any reported station of a species of this group is certainly interesting.

Crataegus Pechiana, n. sp.

Leaves rhombic to obovate or ovate, acuminate, gradually narrowed and cuneate at the entire base, and finely often doubly serrate above, with incurved glandular teeth; about half-grown when the flowers open from the 10th to the middle of May and then yellow-green, slightly hairy along the upper side of the midribs, and furnished with large tufts of persistent hairs in the axils of the veins below, and at maturity thin but firm in texture, dull yellow-green on the upper surface, paler on the lower surface, 3–3.5 cm. long and 2–2.5 cm. wide, with slender midribs and 3 or 4 pairs of thin primary veins; petioles slender, wing-margined at the apex, villose on the upper side, usually becoming red in the autumn, 8–12 mm. in length; leaves on vigorous shoots mostly broadly ovate, abruptly acuminate, cuneate at the base, more coarsely serrate, occasionally slightly lobed, often 4 cm. long and 3 cm. wide, with linear entire caducous stipules. Flowers 1.3–1.5 cm. in diameter, in many-flowered glabrous corymbs, with linear obovate to linear bracts and bractlets, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from wide bases, acuminate, entire, glabrous, reflexed after anthesis; stamens 15; anthers pink; styles 5. Fruit ripening in October, on drooping pedicels, in few-fruited clus-

ters, subglobose, often slightly broader than high, orange-red, 8–9 mm. in diameter; calyx inconspicuous, with a narrow deep cavity, the lobes usually deciduous from the ripe fruit; flesh thin, dry and mealy; nutlets 5, acute at the apex, broader and rounded at the base, rounded and slightly grooved on the back, 4–5 mm. long and 2.5–3 mm. wide.

A narrow arborescent shrub with small erect stems and branches, and slender nearly straight glabrous branchlets dark orange-green when they first appear, light orange-brown and lustrous in their first season, darker-colored in their second year, and finally dull gray-brown, and unarmed or furnished with occasional slender straight spines 3-4 cm. in length.

Riverview Park on dry rocky hills in sterile soil above the bluffs of the Mississippi River near Hannibal, Marion County (*J. Davis, 56,* type, May 13, 1909, October 6, 1911).

From *Crataegus Davisii* this species is distinct in habit, in the shape of the leaves, in the smaller flowers and in the calyx of the fruit which has a deep narrow cavity, while in the fruit of *Crataegus Davisii* the cavity is broad and shallow.

The only publication devoted to the flora of northeastern Missouri appeared in a list of the plants growing at Louisiana, on the Mississippi River not far below Hannibal, in a "Catalogue of the United States Plants in the Department of Agriculture" issued for exchange purposes by Isaac Newton—then Commissioner, in 1866, the authorship of which has been ascribed to Mr. F. Pech, and it is fitting that his name should be associated with one of the thorns of this part of the state.

PRUINOSAE.

Crataegus seducta, n. sp.

Glabrous with the exception of the hairs on the calyx-lobes. Leaves ovate, acuminate, rounded, truncate, slightly cordate or abruptly cuneate at the broad base, coarsely doubly serrate, with straight glandular teeth, and divided into 4 or 5 pairs of short broad lateral lobes; nearly one-third grown when the flowers open about the 20th of April and then thin, yellow-green and pale below, and at maturity thick, dark blue-green on the upper surface, pale blue-green on the lower surface, 6.5–8 cm. long and 6–7 cm. wide, with slender midribs, and 4 or 5 pairs of thin primary veins remote from each other

and extending to the points of the lobes; petioles slender, sparingly glandular, with persistent glands, 3–3.5 cm. in length; stipules linear-obovate, acuminate, more or less falcate, glandular-serrate, bright red, usually persistent until the flowers open; leaves on vigorous shoots more coarsely serrate, sometimes more deeply divided by narrow sinuses into acuminate lobes, often 10 cm. long and 8 cm. wide. Flowers 2 cm. in diameter, on slender pedicels, in mostly 4–7-flowered corymbs, the lower peduncles from the axils of upper leaves, their bracts and bractlets obovate to linear, glandular, red, conspicuous early in the season; calyx-tube broadly obconic, the lobes gradually narrowed from broad bases, abruptly acuminate, laciniately glandular-serrate near the middle, sparingly villose on the upper surface, reflexed after anthesis; stamens 20; anthers dark rose color; styles 4 or 5. Fruit ripening in October, on slender erect pedicels, in few-fruited clusters, broader than high, slightly angled, green blotched with red, 10–11 mm. wide and 8–9 mm. high; calyx little enlarged, with a short tube, a wide deep cavity rounded in the bottom, and spreading lobes often deciduous from the ripe fruit; flesh thin, dry and hard; nutlets 4 or 5, thin and rounded at the ends, rounded and irregularly grooved on the back, about 5 mm. long and 4 mm. wide.

Rich woods, Noel, Joplin County (*B. F. Bush, 5,* type, August 8 and October 12, 1908, April 25 and August 4, 1909).

I have no notes on the size, habit and character of the bark of this species. It differs from *Crataegus bracteata* Sargent, which is common in Joplin County, in its thicker leaves, rather smaller flowers, the smaller bracts and bractlets of the inflorescence, and in the smaller calyx of the fruit. It is, however, best distinguished from *Crataegus bracteata* by the absence of the short hairs on the upper surface of the young leaves, for the presence or absence of such hairs on the leaves of the Pruinosae is constant in the different species of this group and an important character for their arrangement.

MOLLES.

Crataegus dasyphylla, n. sp.

Leaves ovate, acute, rounded or abruptly cuneate at the broad base, coarsely doubly serrate, with straight glandular teeth, and sometimes slightly lobed above the middle; about one-third grown when the flowers open from the 10th to the middle of April, and then coated above with soft white hairs and thickly covered below with hairy tomentum, and at maturity thin, yellow-green, smooth on the upper

surface, hoary-tomentose on the lower surface, 8–9 cm. long and 6–7 cm. wide, with slender midribs and 4 or 5 pairs of thin primary veins extending to the points of the lobes; petioles slender, slightly wing-margined at the apex, tomentose early in the season, becoming villose, 2.5–3 cm. in length; leaves on vigorous shoots ovate, acuminate, more or less deeply cordate, more coarsely serrate and often 10 cm. long and broad. Flowers up to 3.5 cm. in diameter, on stout pedicels, in compact, mostly 7–15-flowered corymbs, with oblong-obovate acuminate falcate villose bracts and bractlets persistent until the flowers open; calyx-tube broadly obconic, thickly covered like the pedicels with long matted pale hairs; calyx-lobes gradually narrowed from wide bases, acuminate, laciniately glandular-serrate, villose; stamens 20; anthers rose color; disk broad, deeply fluted, lemon yellow; styles 4 or 5. Fruit ripening in October, on slender hairy pedicels in few-fruited drooping clusters, short-oblong, rounded and pubescent at the ends, crimson, marked by small pale dots; calyx-cavity narrow, deep, pointed in the bottom, the lobes erect, often deciduous from the ripe fruit; flesh thick, dry and mealy; nutlets 4 or 5, rounded at the ends, rounded and slightly grooved on the back, about 7 mm. long and 3.5 mm. wide, the hypostyle extending to the middle of the nutlet.

A small tree with a tall slender stem 8-10 cm. in diameter, covered with dark scaly bark, few erect slender branches and stout slightly zigzag branchlets coated when they first appear with matted white hairs, becoming nearly glabrous, reddish brown, lustrous and marked by small pale lenticels at the end of their first season and light gray-brown in their second year, and armed with numerous slender straight chestnut brown spines 2.5-4 cm. long.

In rich moist soil along Turkey Creek, near Joplin, Joplin County, rare (*E. J. Palmer, 34,* type, April 18, 19 and 23, and October 1, 1909; *34A,* April 23, 1909).

This species is related to *C. lanuginosa* Sargent of the same region but differs from it in its larger, thinner and smoother leaves and in their longer petioles. The flowers, which open two weeks earlier, are much larger and perhaps as large or larger than those of any American species. The fruit differs in a less conspicuous calyx with a narrow cavity pointed in the bottom, while that of the fruit of *Crataegus lanuginosa* is shallow and broad at the bottom. The hypostyle of the nutlets of *Crataegus lanuginosa* is much

less prominent and conspicuous. One of the characters of *Crataegus lanuginosa* is the unusual development and number of the spines. On *Crataegus dasyphylla* the spines are smaller and much less numerous.

MICROCARPAE.

CRATAEGUS APIIFOLIA, Michaux.

The type of this species is from the southeastern states, and in the southeastern states so far as I have been able to observe the anthers are bright rose color. West of the Mississippi River, however, where *Crataegus apiifolia* is very common and grows to its largest size, the anthers are yellow. There appears to be no other difference in the plants from the two regions, and this difference in the color of the anthers seems a purely geographical one, for there is yet no evidence that plants with rose-colored and yellow anthers ever mingle. This geographical variety appears so remarkable that it should be recognized, but until other differences can be found the trans-Mississippi tree had best be called variety **flavanthera, n. var.**

This is an addition to the Missouri flora, for Mr. E. J. Palmer found a single plant at Joplin, May 10, 1907, and October 28, 1908. He has also found it at Branson in Taney County, on October 20, 1907. This variety is very common in southern Arkansas, eastern Texas and western Louisiana.

TOMENTOSAE.

Crataegus simulata, n. sp.

Leaves ovate to oval or slightly obovate, acute or abruptly acuminate, cuneate or rarely rounded at the base, and coarsely serrate, with straight glandular teeth; nearly fully grown when the flowers open from the 10th to the middle of May and then yellow-green, roughened above by short white hairs, and villose on the midribs and on the under side of the primary veins, and at maturity thin, glabrous, yellow-green, 4–4.5 cm. long and 2.5–3 cm. wide, with slender midribs and usually 5–7 pairs of thin primary veins; petioles stout, broadly wing-margined sometimes nearly to the base, densely villose on the upper side early in the season, becoming glabrous, 1–1.2 cm. in length; leaves on vigorous shoots abruptly acuminate, concave-cuneate at the base, more coarsely serrate and occasionally slightly lobed above the

middle, often 7 cm. long and 4–5 cm. wide. Flowers 1.8 cm. in diameter, on stout nearly glabrous pedicels, in dense usually 3–8-flowered slightly villose corymbs, the lower peduncles from the axils of upper leaves; calyx-tube narrowly obconic, glabrous, the lobes long, slender, acuminate, coarsely glandular-serrate, glabrous on the outer surface, slightly hairy on the inner surface, reflexed after anthesis; stamens 20; anthers dark red or purple; styles usually 3. Fruit ripening in October, on long pedicels, in few-fruited clusters, short-oblong, dull orange-red, 8–10 mm. long and 7–9 mm. in diameter; calyx prominent, with a distinct neck and a deep narrow cavity, the lobes mostly deciduous from the ripe fruit; flesh thin, dry and mealy; nutlets usually 3, rounded at the ends, rounded and ridged on the back, with a broad low grooved ridge, penetrated on their inner faces by shallow cavities, about 7 mm. long and 3 mm. wide.

A small tree 1-2.5 m. high, with stems covered with dark gray slightly scaly bark, few erect intricately arranged branches and slender nearly straight branchlets dark orange-green and slightly villose when they first appear, becoming glabrous and dark dull chestnut brown during their first season and light or dark grayish brown the following year, and armed with slender nearly straight chestnut brown spines long-persistent on the stems and upper branches.

In moist rich soil at the base of hills on Turkey Creek, near Joplin, Joplin County, common (*E. J. Palmer, 46A,* type, May 13 and September 21, 1909; *46,* May 15 and September 21, 1909; *46B,* sometimes with as many as 24 flowers in a corymb, May 13, 1909; *46C,* May 20 and September 21, 1909); Scotland, Jasper County (*E. J. Palmer, 47,* May 18, 1909).

From the other thin-leaved species of Tomentosae, *Crataegus simulata* differs in the shape of the much smaller leaves which become entirely glabrous, in the nearly glabrous corymbs, and the absence of hairs on the pedicels and calyx-tube. The plants in habit and foliage look like a thin-leaved species of Crus-galli, for which it might be easily mistaken, but the cavities on the inner faces of the nutlets show its true position.

REVISION OF THE AGAVES OF THE GROUP APPLANATAE.

BY WILLIAM TRELEASE.

Though its relationship to the other species here brought together is less close than that which they bear to one another, a circumstance probably connected with its geographic isolation and their own occurrence over a relatively small area, *Agave applanata* may be taken as the initial of a group of hard-leaved agaves best known in European gardens by this species, and to American botanists by *A. Parryi.* When immature, *applanata* resembles some of the other species so closely that they have been taken to be varieties of it, but this resemblance grows less as the adult stage is reached, so that at maturity it differs markedly from them in aspect, as it does always in details.

Of the ten species of this group, *applanata* is at home on the lava-beds above Jalapa, *Wislizeni* and *parrasana* are found in Coahuila and Nuevo Leon, *Patonii* occurs in middle Durango and *chihuahuana* in middle Chihuahua. The other five species are confined to Arizona, New Mexico and Texas, and the adjacent parts of Mexico. Neither is known to range far, the most remote localities in which a single species has been collected being southern Coahuila, where the type of *Wislizeni* was found, and northern Nuevo Leon where what appears to be the same species occurs.

The Applanatae are not very closely allied to any other group of Euagave; but on the one hand they are evidently related to the continental groups typically represented by *A. americana* and *A. atrovirens,* and on the other they appear to have given origin to the Umbelliflorae of Lower California.

Applanatae.

Usually rather small cespitose acaulescent plants with rather numerous hard fleshy nearly or quite smooth gray or white usually short and broad stiff and straight leaves with rather stout straight or somewhat flexuous openly grooved or flattened decurrent spine and rather large subdistant

prickles; moderately ample long-stalked panicles; medium-sized or rather large yellow or yellowish flowers; moderate-sized or rather large stipitate capsules; and medium-sized or rather large seeds. Not known to be bulbiferous except for one form.—North American table-land, centering in the district between Arizona and New Mexico, and Durango and Coahuila: one species (the type) on the flanks of the Orizaba range.

SYNOPSIS.

Leaves elongated (1 m. or more), lanceolate. Filaments inserted at about the upper third of the perianth tube. *A. applanata.*
Leaves short (scarcely .5 m.), oblong or roundish.
Perianth tube nearly or quite as long as the segments, bearing the filaments at about its upper fourth. Seeds small (4–5 × 6–7 mm.)
Leaves rather thin with slender spine. Capsules moderate.
Leaves dull gray, scarcely repand. *A. Wislizeni.*
Leaves glaucous-green, often repand. *A. parrasana.*
Leaves thick: spine stout. Capsules large. *A. chihuahuana.*
Perianth tube shorter than the segments.
Filaments inserted at about its upper third, seeds medium (5 × 7 mm.) *A. Havardiana.*
Filaments inserted nearly in the throat.
Plants nearly globose. Flowers rather large, with deep tube. Pedicels stout. Seeds rather large (6 × 8 mm.)
Leaves very broad. Capsules large.
Leaves acute. Tube open, more than half as long as the segments. *A. huachucensis.*
Leaves acuminate. Tube narrow, about half as long as the segments. *A. Patonii.*
Leaves elongated. Capsules rather small. *A. Parryi.*
Plants less globose. Flowers rather small, with shallow tube. Pedicels slender. Seeds rather small (4 × 6 mm.)
Gray. Capsules blackish, not stipitate. *A. Couesii.*
White. Capsules pale, stipitate. *A. gracilipes.*

AGAVE APPLANATA Koch, Wochenschr. Verein Beförd. Gartenbau. **1862:** 83, 198, 325; **1865:** 186; Belg. Hort. **12:** 110.—**v. Jacobi,** Hamburg. Gart.-Zeit. **20:** 550. 1864; **22:** 168; Versuch. 48, 219; Nachtrag. 4, 6.—Regel, Gartenflora. **14:** 265.—Rept. Internat. Hort. Exhib. London. 1866. 296–7.—Hereman, Paxton's Dict. 18.—Van Houtte, Cat. 123: 32.—Laurentius, Cat. **1868:** 113.—Lyon Hort.

1868: 317; **1888**: 317; **1900**: 368.—Menand, Cat. Pl. Albany. 1869: 18; 1877: 19.—J. Verschaffelt, Cat. 14: 73; 18: 35.—Ellemeet, Belg. Hort. **21**: 116.—Haage & Schmidt, Cat. **1873**: 14.—De Cock, Cat. 10: 7.—Baker, Gard. Chron. n. s. **7**: 717. *f. 115;* Handbook Amaryllid. 173; Kew Bull. **1892**: 3, and Add. Ser. **2**: 219.—Ricasoli, Bull. Soc. Tosc. Ort. **3**: 213. *f. 21;* Utilita dei Giardini d'Acclimazione. 7.—Peacock, List. 1.—Von der Heiden, Cat. **1879**: 3, 4, *f;* **1880**: 11. *f.*—Viviand-Morel, Lyon Hort. **1881**: 341.—Todaro. Hort. Panormit. **2**: 29. *pl. 30;* Bot. Centralbl. **46**: 190.—Hemsley, Biol. Centr.-Amer. **3**: 339.—Hanbury, Gard. Chron. n. s. **20**: 54.—Terracciano, Primo Contributo. 48; Boll. Ort. Bot. Palermo. **2**: 125.—Nicholson, Dict. **1**: 38; Dict. Prat. **1**: 79.—Taplin, Gard. & For. **4**: 261.—Franceschi, Gard. & For. **8**: 228.—Graebener, Gartenwelt. **8**: 49. *f.*—Kew Hand List Tend. Monocot. 107.—Roland-Gosselin, Rev. Hort. **71**: 255.—Weber in Bois, Dict. 51.—Berger, Gartenwelt. **2**: 593. *f.*—Simon, Cat. **[1900]**: 15.—Rodigas, Semaine Hort. n. s. **4**: 279, 281. 476. *f. 91.*—Monatsschr. f. Kakteenkunde. **3**: 115.—Rose in Bailey. Cyclop. **1**: 34.—Segura, El Maguey. 4 ed. 73.—Trelease, Wiesner Festschr. 355.—Möller's D. Gärtn.-Zeit. **1903**: 528. *ff.;* **1905**: 528.—Rev. Hort. (Marseille). **1907**: 32.—Endlich, Beihefte Tropenpflanzer. **9**: 279.—Müller, Bot. Zeit. Abt. I. **67**: 116. 135, 138-9. *pl. 2. f. 20.*

A. aplanata **Koch, Belg. Hort. 1864: 303.**

A. applanaat **Griph, Lyon Hort. 1879: 209.** ***f.***

A. applanata major **v. Jacobi, Versuch. 219. 1866.—Peacock, List. 1.**

A. applanata subnivea **v. Jacobi,** ***l. c.*** **219. 1866.**

Little cespitose, acaulescent. Leaves nearly smooth, glaucous, oblong-lanceolate, gradually acute, very openly concave, 10–15 × 100–150 cm., stiffly erect-spreading: spine often somewhat flexuous, gradually tapered, from purplish slate-colored becoming dull gray, 6–7 × 35–45 mm., very long-decurrent: prickles similarly colored, 25–35 or even 50 mm. apart, 5–8 mm. long, straight or for the most part gently recurved or somewhat hooked, elongated-triangular, abruptly lenticularly widened to 20 or 30 mm. at base or confluent throughout in a slightly concaved horny margin about 1 mm. wide which, like the spine, is sparsely granular. Inflorescence 8–10 m. high, the upper

third narrowly oblong-paniculate: scape moderate: bracts triangular, close, somewhat spreading: branches horizontal or slightly ascending: pedicels slender, about 5 mm. long. Flowers fetid, greenish yellow, 60–70 mm. long: ovary 35–40 mm. long, fusiform: tube conical, 15 mm. deep: segments 5 × 15 mm., equaling the tube but less than half as long as the ovary: filaments inserted about the upper third of the tube, 45–50 mm. or more long and fully thrice as long as the segments. Fruit?

Southeastern Mexico.—*Pl. 73, 74.*

Specimens examined.—Limon, on the Interoceanic R. R., above Jalapa (*Trelease, 1,* Feb. 1905).

Long cultivated, but of doubtful origin, and greatly misunderstood because of the difference between juvenile, moderately developed, and mature plants. Jacobi notes that somewhere about 1856 Haseloff acquired a plant from a Berlin gardener. Tonel is said by Koch to have exhibited it in Ghent in 1862. Regel reports it in 1865 as imported, like *streptocantha* (*A. Verschaffeltii*) by J. Verschaffelt. At the London exhibition of 1866 awards were made for it to A. Verschaffelt, R. Barclay, W. B. Kellock and C. Pfersdorff, and from this time on it appears in the lists of various dealers, of whom Laurentius alone gives its source,—as Mirador. From this it may, perhaps, be assumed that the Haseloff specimen noted by Jacobi was sent to Berlin somewhere about 1855, when Sartorius sent over the plant variously known as *Sartorii, Noackii, pendula* &c. The Verschaffelt importation is suggestive of the activities of Roezl on the table-land about Puebla, and the spontaneous plant at Limon, toward the point where the plateau falls away, is evidently the same as *applanata* when fully developed in the Mediterranean gardens. In mid-age it is very similar to *Parryi,* which led Miss Mulford to place the latter under it as a variety. Jacobi, himself, recognized two garden varieties: a long-leaved one, var. *major,* and a very white form, var. *subnivea,* neither of which has been heard of for many years. It is reported in the Lyon Horticole, **22:** 370, that pollen of *applanata* was successfully used for the fertilization of *maculata* [*Terraccianoi?*], but the subsequent history of the cross does not appear.

AGAVE WISLIZENI Engelmann, Trans. Acad. St. Louis. **3**: 320. 1875; Bot. Works. 313.—Baker, Gard. Chron. n. s. **8**: 40; Handbook Amaryllid. 175.—Ricasoli, Bull. Soc. Tosc. Ort. **3**: 235.—Terracciano, Primo Contributo. 37. —Hemsley, Biol. Centr.-Amer. **3**: 352.—Watson, Proc. Amer. Acad. **18**: 162.—Nicholson, Dict. **1**: 41; Dict. Prat. **1**: 88.—Lubbock, Seedlings. **2**: 575.—Segura, El Maguey. 4 ed. 80.—Braun, Pflanzer. **2**: 232.—Endlich, Beihefte Tropenpflanzer. **9**: 279.

A. scabra Salm, Bonplandia. **7**: 86, 89. 1859; Wochenschr. Verein Beförd. Gartenbau. **1861**: 178, 181; Fl. des Jard. **5**: 117, 123.—Koch, Wochenschr. Verein Beförd. Gartenbau. **3**: 24; **8**: 186; Belg. Hort. **12**: 188; Fl. des Jard. **4**: 109.—v. Jacobi, Hamburg. Gart.-Zeit. **21**: 123; Versuch. 6, 7, 16, 88.

?*A. scabra oblongata* v. Jacobi, Nachtrag. 6. 1867.

?*A. Wislizenia* Van Geert, Cat. 58: 25. 1865–6.

A. Wislizenii Kew Hand List Tend. Monocot. 123. 1897.

A. Noah Nickels, Cat. 26: 20.

Agave sp. Nelson, Yearb. U. S. Dept. Agr. 1902: 314.—Fairmount Park Cat. Tender Pl. 8. *pl.* 1907.

Acaulescent. Leaves essentially smooth, dull gray, rather thin and pliable for the group, broadly ovate, very shortly acuminate, deeply concave, 10–15 × 20–25 cm., stiffly erect-spreading: spine somewhat curved, dark chestnut or graying, 3–4 × 15–20 mm., round-grooved to beyond the middle, decurrent for about its own length: prickles similarly colored, 15–20 mm. apart, 3–8 mm. long, rather straight above, reflexed or recurved or sometimes hooked in either direction below, narrowly triangular, lenticular or hardened onto the tops of low prominences, the intervening margin slightly concaved. Inflorescence 4 m. high, the upper half ovoid-paniculate: scape rather stout: bracts deltoid, not imbricated, suberect: branches nearly horizontal: pedicels about 5 mm. long. Flowers yellow, 55–65 mm. long: ovary 25–30 mm. long, fusiform: tube narrowly conical, 12–15 mm. deep: segments 5 × 10–12 mm., rather shorter than the tube and scarcely half as long as the ovary: filaments inserted about the upper fourth of the tube, 35 mm. long, about thrice as long as the segments. Capsules rather narrowly oblong, 15 × 40–45 mm., somewhat stipitate and beaked: seeds 4 × 6 mm.

North-central Mexico.—*Pl. 75-79.*

Specimens examined:—COAHUILA. San Sebastian, in the vicinity of Parras (*Wislizenus, 280,* May 10, 1847,—the type).

Though early introduced into European gardens, this striking plant still remains among the little-known species. Specimens which are still small occur in the living collections of the Missouri Botanical Garden, recorded as from Engelmann, and from these it is impossible to distinguish other specimens distributed from Lampazos, Nuevo Leon, by Mrs. Anna B. Nickels, under the name *A. Noah*.

AGAVE PARRASANA Berger, Notizblatt Bot. Gart. Berlin. **4**: 250. 1906.

Aspect and thinness of leaf of *A. Wislizeni*, but the leaves of a clearer green overlaid with thin bloom, more acuminate—sometimes long-attenuate, and with the rather heavier prickles widened onto the tops of more or less developed fleshy prominences. Flowers? Capsules stoutly oblong, about 20 × 50 mm.: seeds?

North-central Mexico.—*Pl. 80, 81.*

Specimens examined:—COAHUILA. Sierra de Parras (*Purpus,* 1905,—the type, and capsules).

In the region of *A. Wislizeni*: remarkably variable in leaf form. Capsules and seeds from the type locality of this, received from Dr. Purpus in December 1911, are scarcely distinguishable from those of *Wislizeni.*

Agave chihuahuana Trelease.

Aspect of *A. Wislizeni.* Leaves thicker, essentially smooth, light gray-green, broadly lance-oblong or ovate-oblong, acuminate, openly concave, dorsally somewhat valleculate, 10–15 × 15–25 cm., stiffly erect-spreading: spine nearly straight, purplish chestnut or somewhat slate-colored, graying in age, at first glossy, 4–7 × 25–35 mm., round- or flat-grooved nearly to the end, decurrent for about its own length: prickles 15–25 mm. apart, about 6 mm. long, mostly somewhat retrorse or gently recurved, triangular from dull ashen lenticular bases. Inflorescence paniculate: pedicels from very short to about 10 mm. long. Flowers yellow, 65–70 mm. long: ovary 35 mm. long, fusiform: tube conical, 10–15 mm. deep: segments 5 × 15–20 mm., longer than the tube, half as long as the ovary: filaments inserted about the upper fourth of the tube, 45–60 mm. long and about thrice as long as the segments. Capsules narrowly pyriform-oblong, 15 × 55–65 mm., thickly stipitate, beaked: seeds dull and rather small, 4 × 6 mm.

North-central Mexico.—*Pl. 82, 83.*

Specimens examined:—CHIHUAHUA. Hills near Chihuahua (*Pringle, 958,* 1886,—the type, distributed as *A. Wis-*

lizeni). Sta. Eulalia (*Palmer, 138,* 1908; *Rose, 11671,* 1908). Cusihuiriachic (*Rose, 11654,* 1908). Sierre Madre Mts., S. W. Chihuahua (*Endlich, 1201,* 1906).

Agave Havardiana Trelease.

A. americana Torrey, Bot. Bound. 213. 1859.
Agave sp. Engelmann, Trans. Acad. St. Louis. 3: 321. 1875; Bot. Works. 314.
A. Wislizeni Havard, Proc. U. S. Nat. Mus. 8: 519. 1885.—Coulter, Contr. U. S. Nat. Herb. 2: 430.—Nelson, Yearbook U. S. Dep. Agr. 1902: 315. *pl. 33.*

Aspect of *A. Parryi,* but larger. Leaves essentially smooth, gray, lance-oblong, little acuminate, openly concave, 8–15 × 25–40 cm., stiffly erect-spreading: spine slightly flexuous, from red-chestnut becoming gray, 5–7 × 30–45 mm., flat grooved well toward the end, decurrent for about its own length: prickles similarly colored, 15–25 or 30 mm. apart, 3–8 mm. long, mostly recurved or even hooked, rather heavily triangular, lenticular when the margin is nearly straight or hardened onto the tops of prominences when it is somewhat repand, sometimes confluent. Inflorescence 4–5 m. high, the upper third ovoid-paniculate: scape moderate: bracts triangular, not crowded, spreading or reflexed in age: pedicels 5–10 mm. long. Flowers yellow, about 65 mm. long; ovary 35 mm. long, fusiform: tube openly conical, 15–18 mm. deep: segments 5 × 12–14 mm., shorter than the tube and about one-third as long as the ovary: filaments inserted about the upper third of the tube, 50 mm. long, about four times as long as the segments. Capsules narrowly oblong, 15–20 × 60 mm., stipitate and beaked: seeds 5 × 7 mm.

Region of the Great Bend of the Rio Grande River.—*Pl. 84-86.*

Specimens examined:—Texas. Wild Rose-Limpio-Pass (*Wright, 1906,* 1851). Chenati Mountains (*Havard,* 1880). Guadaloupe Mountains (*Havard,* Oct. 1881,—the type). Chisos Mountains (*Havard,* August 1883).

Agave huachucensis Baker, Handbook Amaryllid. 172. 1888.—Gard. & Forest. 8: 184. *f.;* 229.—Kew Hand List Tend. Monocot. 113.—Segura, El Maguey. 4 ed. 72.—Trelease, Pop. Sci. Monthly. 70: 209.—Sajo, Prometheus. 20: 23.

A. huachucaensis Sargent, Gard. & Forest. 8: 184. 1894.
A. applanata huachucensis Mulford, Rept. Mo. Bot. Gard. 7: 85. *pl. 40, 41.* 1896.
A. Parryi Britton & Kearney, Trans. N. Y. Acad. 14: 26. 1894.

Somewhat cespitose, acaulescent. Leaves essentially smooth, gray, very broadly oblong, little acuminate, very openly concave, 10–16 × 15–30 cm., stiffly erect-spreading: spine straight or somewhat flexuous, from reddish chestnut becoming gray, 5–6 × 25 mm., very openly grooved nearly to the end, shortly decurrent: prickles similarly colored, about 15 mm. apart, 4–7 mm. long, usually strongly reflexed, sometimes doubly curved, narrowly triangular, abruptly somewhat lenticularly widened on the usually concaved margin. Inflorescence 4–5 m. high, the upper half oblong-paniculate: scape rather stout: bracts broadly triangular, rather close, suberect: branches somewhat ascending: pedicels about 5 mm. long. Flowers yellowish, 55–75 mm. long: ovary 25–45 mm. long, fusiform: tube openly conical, 10 mm. deep: segments 6 × about 15 mm., scarcely twice as long as the tube and one-half to one-third as long as the ovary: filaments inserted a little below the throat, 50–55 mm. long, thrice as long as the segments. Capsules broadly oblong, 20–25 × 55–75 mm., stipitate and beaked: seeds 6 × 8 mm.

South-central Arizona.—*Pl. 87-89.*

Specimens examined:—ARIZONA. Huachuca Mountains (*Pringle,* 1884,—the type; *Toumey,* 1894; *Wilcox,* 1895; *Brewer,* 1907; *Ferriss,* 1908). Sta. Catalina Mountains (*Rose, 101,* 1908).

Agave Patonii Trelease.

Acaulescent. Leaves essentially smooth, light gray-green, very broadly oblong, quickly acuminate, openly concave, as much as 20 × 30 cm., stiffly erect-spreading; spine somewhat flexuous, from purple-chestnut becoming dull gray-brown, 6 × 30–35 mm., openly grooved nearly to the end, decurrent for about its own length; prickles similarly colored, 20–25 mm. apart, 6–7 mm. long, retrorse or recurved, triangular from low ashen bases, the intervening margin somewhat concave. Inflorescence paniculate; pedicels about 5 mm. long. Flowers about 65 mm. long: ovary about 30 mm. long, subfusiform: tube narrowly conical, 10 mm. deep: segments 5 × 20 mm., about twice as long as the tube and two-thirds as long as the ovary: filaments inserted in the throat, about 45 mm. long, somewhat more than twice as long as the segments. Capsules rather broadly oblong, 20 × 55–60 mm., stipitate and beaked: seeds glossy, 6 × 8–9 mm.

North-central Mexico.—*Pl. 90.*

Specimens examined:—DURANGO. Chinacates (*Patoni,* April 1911,—the type). Tobar (*Palmer, 228,* 1906).

AGAVE PARRYI Haage & Schmidt, Cat. **1873**: 14, without description.— **Engelmann,** Trans. Acad. St. Louis. **3**: 311, 582. 1875; in Rothrock, Bot. Wheeler. 267; Gard. Chron. n. s. **12**: 237. *f. 39;* Bot. Works. 310, 318, 320–322.— Baker, Gard. Chron. n. s. **8**: 40; Handbook Amaryllid. 175.—Menand, Cat. Pl. Albany. 1877. 20.— Ricasoli, Bull. Soc. Tosc. Ort. **3**: 234.—Belg. Hort. **1880**: 113.—Garden. **1881**: 460.—Newberry, Pop. Sc. Monthly. **32**: 40.— Hemsley, Biol. Centr.-Amer. **3**: 347,—should read New Mexico.— Terracciano, Primo Contributo. 42.—Greene, Erythea. **1**: 52.— Orcutt, W. A. Sci. **7**: 96.—Coulter, Contr. U. S. Nat. Herb. **2**: 430. —Kew Hand List Tend. Monocot. 117.—Engler, Entwick. Pflanzenwelt. **2**: 219.—Möller's D. Gärtn.-Zeit. **18**: 3. *f.* —Urbina, Naturaleza. ii. **3**: 256.—Simon, Cat. [**1900**]: 16.—Segura, El Maguey. 4 ed. 79.—Trelease, Pop. Sc. Monthly. **70**: 209.—Sajo, Prometheus. **20**: 23.— Mittheil. D. Dendr. Ges. 2 ed. 423, 448.

A. americana latifolia Torrey, Bot. Bound. 213. 1859,—as to Emory.— Standley, Contr. U. S. Nat. Herb. **13**: 170, 179.

Agave sp. Emory, Recon. 152. 1848.— Hall, Out West. 29. 11. *f.*— Technical World Mag. **14**: 165. *f.*

A. applanata Parryi Mulford, Rept. Mo. Bot. Gard. **7**: 83. *pl. 36–39, 42–43.* 1896.—Lewton, Amer. Journ. Pharmacy. **72**: 331.—Gard. Chron. iii. **33**: 342, 364.— Braun, Pflanzer. **2**: 217; **4**: 73.— Schimper, Pflanzen Geogr. 673. *f. 378.*—Bowles, Journ. R. Hort. Soc. **34**[1]: 30.—Goss, Bull. N. Mex. Exp. Sta. 44.— Mittheil. D. Dendrol. Ges. 2 ed. 448.

A. applanata Cactus Journ. **2**: 56. *pl.* 1899.

A. crenata Jacobi, Versuch. 229. 1866,— as to Emory citation only.

A. Mescal Jacobi, Versuch. 231. 1865,— as to New Mexico.

A. Marcusea Rafarin, Rev. Hort. **1877**: 36.

A. Marcusi L. De Smet, Suppl. Cat. 9: 2, 17. 1876; 10: 1, 31, 34; 11: 9. — Belg. Hort. **1877**: 139. — Steiner-Pfersdorff, Cat. **1877**: 29.

A. Marensi Kew Hand List Tend. Monocot. 115. 1897.

A. Parreyi Croucher, Gard. Chron. n. s. **14**: 374.

A. Paryi Ellemeet, Belg. Hort. **1871**: 121.

A. Payrii De Laet, Cat. **1904**: 38.

A. Parayi De Laet, Cat. [1908-9]: 25.

Solitary to densely cespitose, acaulescent. Leaves essentially smooth, gray, broadly oblong, acute or somewhat acuminate, very openly concave, 6–10 × 25–30, or exceptionally 15 × 40 cm., stiffly erect-spreading: spine nearly straight, gradually tapered, from chestnut becoming gray, 5–6 × 20–25 mm., very openly grooved or becoming flattened nearly to the end, rather long-decurrent: prickles similarly colored, 15–20 mm. apart, 3–5 mm. long, straightish or prevailingly gently recurved, narrowly triangular, abruptly lenticularly widened to 5 or 10 mm. at base or the upper ones confluent on the slightly concaved margin. Inflorescence [3–5 m. high, the upper third or half oblong-paniculate: scape moderate: bracts triangular, rather close, spreading or reflexed in age: branches somewhat ascending: pedicels rather stout, about 5 mm. long. Flowers creamy yellow, 55–60 mm. long; ovary about 30 mm. long, fusiform: tube openly conical, 8–10 mm. deep: segments 5 × 17 mm., about twice as long as the tube and half as long as the ovary: filaments inserted nearly in the throat, 35 mm. long and about twice as long as the segments. Capsules dark brown, broadly oblong or pyriform, 20 × 35 –40 mm., little stipitate but somewhat beaked: seeds 6 × 8 mm.

Northern Arizona to southeastern New Mexico (where it reaches its greatest development), and northern Chihuahua. —*Pl. 91-93.*

Specimens examined:—ARIZONA. Rocky Cañon (*Rothrock, 274,* 1874,—to be accepted as the type, since it afforded the first complete material). San Francisco Mountains (*Parry,* 1867,—the source of the earlier distribution of seeds into European gardens). Without locality (*Bischoff,* 1871). NEW MEXICO. Copper Mines, Sta. Rita, near Silver City (*Emory,* 1846,—the type of *A. americana latifolia*). Fort Bayard (*Bertolet,* 1877). Silver City (*Greene,* 1880). Bear Mountain (*Rusby, 411,* 1881). Las Cruces (*Wooton,* 1895). Humboldt Mountain (*Mulford, 397, 397a,* 1895). Mogollon Mountains (*Metcalfe, 262,* 1903). Organ Mountains (*Standley, 541,* 1906). CHIHUAHUA. Mountains near Colonia Garcia (*Wooton, 73,* 1899).

Agave Couesii Engelmann in herb.

A. Parryi Engelmann, Trans. Acad. Sci. St. Louis. 3: 312. 1875; Bot. Works. 310.—As to Coues citation.

Cespitose, acaulescent. Leaves essentially smooth, very gray, dull, nearly oblong, slightly acuminate, very openly concave, about 6 × 25

cm., erect-spreading: spine somewhat flexuous, from garnet becoming blackish gray, 3 × 20 mm., openly grooved nearly to the end, rather long-decurrent: prickles similarly colored, 15–25 mm. apart, 2–3 mm. long, straight or variously and often abruptly curved in either direction, narrowly triangular, somewhat lunately widened onto the tops of low fleshy prominences between which the margin is rather straight. Inflorescence 3 m. or exceptionally 5 high, the upper third oblong-paniculate, with nearly horizontal branches: pedicels about 2 × 5–10 mm. Flowers yellow, fragrant, 25–40 mm. long; ovary about 20 mm. long, oblong; tube open and shallow, about 3 mm. deep; segments about 3 × 15 mm., much exceeding the tube but considerably shorter than the ovary: filaments inserted in the throat, scarcely 20 mm. long or twice as long as the segments. Capsules purplish, small, 15 × 25 mm., oblong-pyriform, somewhat contracted at base and apex: seeds 3–4 × 5–6 mm.

West-central Arizona.—*Pl. 94-97.*

Specimens examined:—ARIZONA. Date Creek, Fort Whipple (*Coues & Palmer, 253,* June 5, 1865,—the type). Prescott (*Miss Kate T. Cory,* September 1911).

An interesting species, long-overlooked, which should prove to be one of the hardiest in cultivation, since it withstands a winter temperature often below 0°F.

For the material on which its general characters are based, I am indebted to the interest of Dr. R. E. Kunzé and the kindness and energy of Miss Cory, to whom the habit photograph is also due.

Agave gracilipes Trelease.

A. americana latifolia Torrey, Bot. Bound. 213. 1859,—as to Bigelow.

A. applanata Trelease, Rept. Mo. Bot. Gard. 4:191; 13:117.—Mulford, Rept. Mo. Bot. Gard. 7:83. *pl. 35.* 1896.

Somewhat cespitose, acaulescent. Leaves essentially smooth, very glaucous, lance-oblong, gradually acuminate, very openly concave, 7–8 × 20 to 12 × 30 cm., rather openly spreading: spine straight or flexuous, from red-chestnut becoming gray, 4–5 × 20–45 or exceptionally 100 mm., very openly grooved nearly to the end, rather long-decurrent: prickles similarly colored, usually 15–20 mm. apart, 2–10 (commonly 5) mm. long, straight and spreading or somewhat recurved or the uppermost upcurved, narrowly triangular, abruptly lenticular and often confluent at base, the intervening margin usually slightly concaved. Inflorescence 2.5 to 5 m. high, oblong-paniculate, with slender ascending branches: pedicels very slender, scarcely 5 mm.

long. Flowers yellow, about 35 mm. long: ovary scarcely 20 mm. long, fusiform: tube very open, 2–4 mm. deep: segments 3×10–15 mm. much exceeding the tube and approaching the ovary in length; filaments inserted in the throat, about 35 mm. long, nearly thrice as long as the segements. Capsules straw-colored, short, 15×30 mm., stipitate and beaked; seeds 4×6 mm.

Extreme western Texas.—*Pl. 98, 99.*

Specimens examined:—TEXAS. Sierra Blanca (*Trelease,* 1892, 1900; *Gilcrease; Mulford, 293, 293a,* 1895,—the types). Rock Creek (*Bigelow*).

EXPLANATION OF PLATES.

All of the detail figures are of natural size and from photographs by the author, unless otherwise noted. Acknowledgment of the source of the habit illustrations is made in connection with the explanation of them.

Plate 73.—*Agave applanata.* 1, Habit, as grown in European gardens, from a photograph made by the author at La Mortola in 1905. 2, Flowers, the lowest one with the nearer size removed (La Mortola, *Berger,* 1907).

Plate 74.—*Agave applanata.* Habit, as it occurs spontaneously, from a photograph by the author on the lava-beds of Limon; and spines and prickles from Limon material.

Plate 75.—*Agave Wislizeni.* Type sheet, in the Garden herbarium. × ⅓.

Plate 76.—*Agave Wislizeni.* Flowers, capsules and seeds: type material.

Plate 77.—*Agave Wislizeni.* Leaf of a plant grown at the Missouri Botanical Garden (No. 5/98) as received from Dr. Engelmann under this name. × ⅓.

Plate 78.—*Agave Wislizeni.* Leaf of a plant of "*A. Noah*" grown at the Missouri Botanical Garden (No. 264/11/11), presented by Mr. A. G. Greiner, who received it from Mrs. Nickels. × ½.

Plate 79.—*Agave Wislizeni.* Reproduction of a habit picture published without name in the catalogue of tender plants issued from Fairmount Park in 1907. Mr. Oglesby Paul informs me that this plant, though not secured directly from Mrs. Nickels, is "*A Noah*" of her list, and that it proved bulbiferous at a later stage.

Plate 80.—*Agave parrasana.* 1, Leaf of the type, from Mr. Berger, × ¾. 2, Capsules, supposed to be of this species, collected in the Sierre de Parras with the type material.

Plate 81.—*Agave parrasana.* Specimens grown at the Missouri Botanical Garden (No. 206/05/1), collected with the foregoing.

Plate 82.—*Agave chihuahuana.* 1, Plant, about to flower, enlarged from a photograph by Dr. J. N. Rose. 2, Spine and prickles of type.

Plate 83.—*Agave chihuahuana.* Flowers, capsules and seeds, from the type.

Plate 84.—*Agave Havardiana.* A type sheet. × ⅓.

Plate 85.—*Agave Havardiana.* 1, Spine, prickles and flowers, from type material. 2, Flowers collected by Dr. Havard in 1884.

Plate 86.—*Agave Havardiana.* End of panicle-division, with capsules and seeds, from type material.

Plate 87.—*Agave huachucensis.* Flowering plants, photographed west of Ft. Huachuca by Dr. Brewer in 1907.

Plate 88.—*Agave huachucensis.* 1, Habit of growth, from a photograph by the author of a plant collected at Ft. Huachuca in 1904. 2, Spine, prickles and flower from material collected in the type locality (*Toumey*, 1894).

Plate 89.—*Agave huachucensis.* Flowers of the type collection (*Pringle*, 1884). 2, Capsules and seeds (*Brewer*, 1907).

Plate 90.—*Agave Patonii.* 1, Flowers and pedicels (*Palmer*, *228*). 2, Spine, prickles, capsules and seeds, from type material.

Plate 91.—*Agave Parryi.* Flowering plant at the Missouri Botanical Garden gathered by Miss Mulford in the vicinity of Ft. Bayard, photographed in 1897.

Plate 92.—*Agave Parryi.* Spines and prickles: 1, From a specimen collected in 1880 by Greene; 2, From a plant cultivated at the Missouri Botanical Garden (No. 200/95).

Plate 93.—*Agave Parryi.* 1, Flowers (*Metcalfe*, *262*). 2, Capsules and seeds (*Bertolet*, 1877).

Plate 94.—*Agave Couesii.* Flowering plants, near Prescott, Arizona, photographed in 1911 by Miss Kate T. Cory.

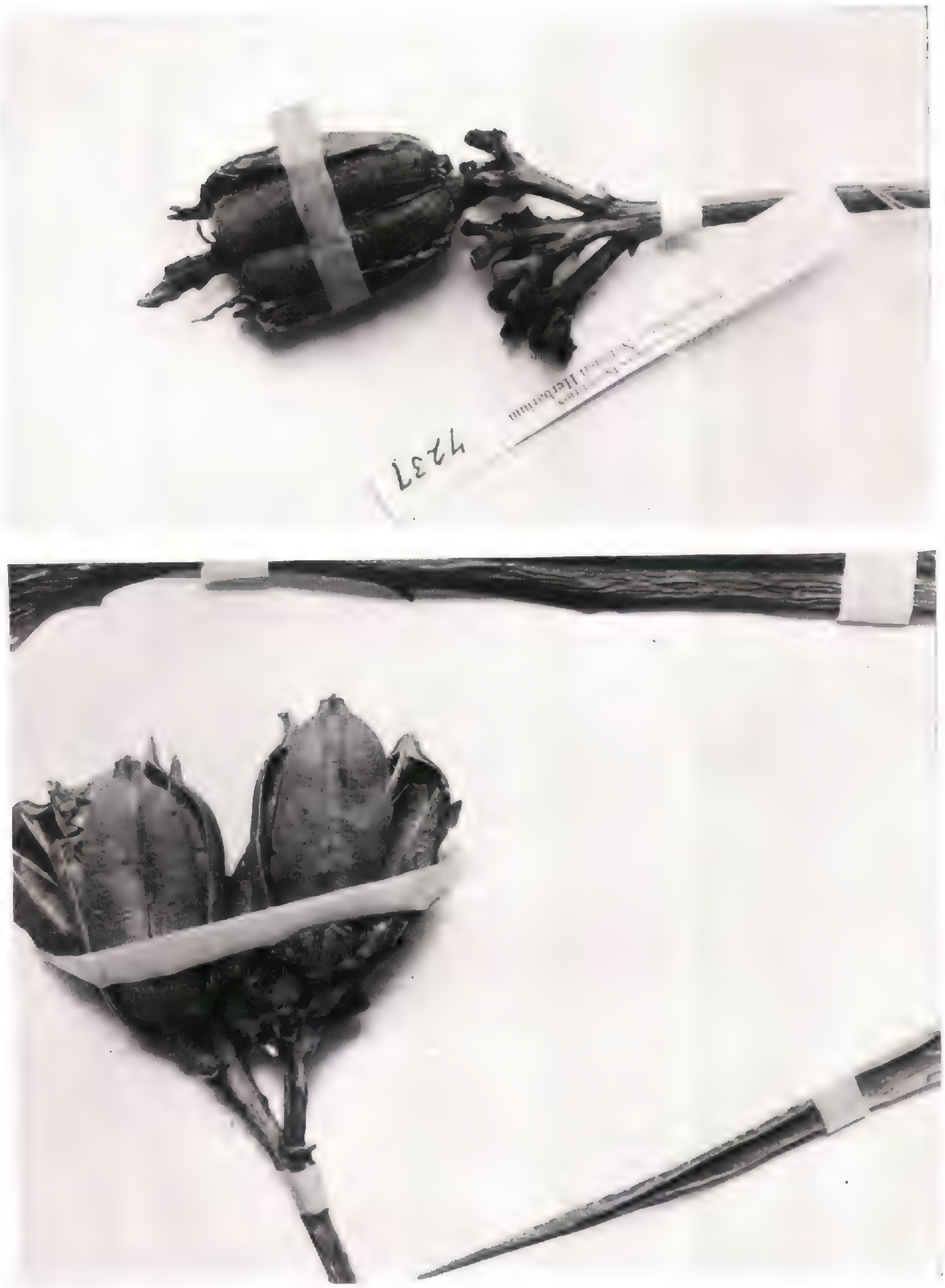
Plate 95.—*Agave Couesii.* Habit, and spine and prickles, from a plant cultivated at the Missouri Botanical Garden (No. 259/11/1), collected near Prescott by Miss Cory.

Plate 96.—*Agave Couesii.* Leaves and panicle-branch, from Prescott (*Miss Cory*, 1911). × ½.

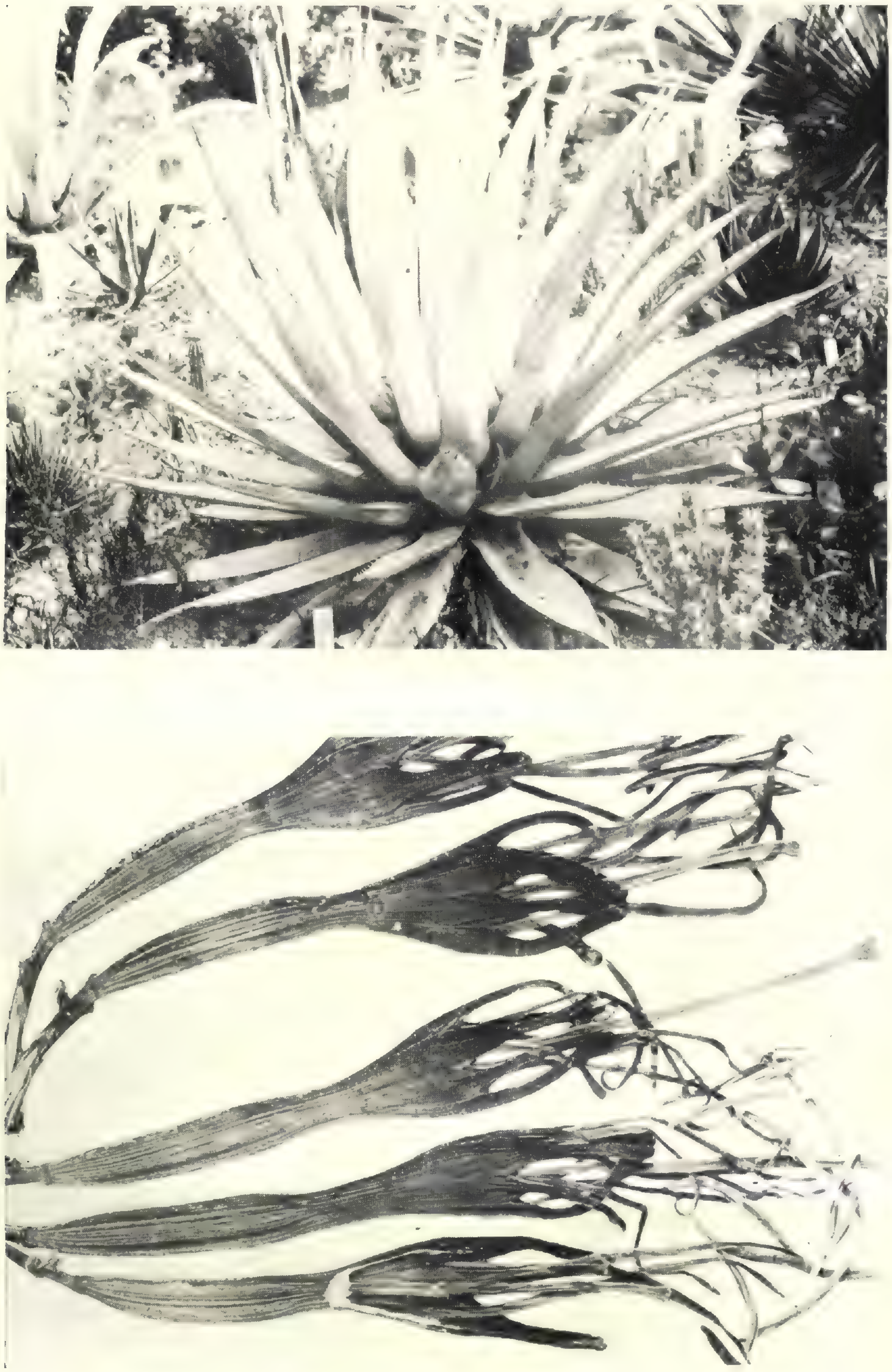
Plate 97.—*Agave Couesii.* 1, Young flowers and pedicels, from the type. 2, Capsules and seeds (*Miss Cory*, 1911).

Plate 98.—*Agave gracilipes.* 1, Habit, from a plant cultivated at the Missouri Botanical Garden in 1895, collected by the author at Sierra Blanca, Texas. 2, Spine and prickles, from Sierra Blanca material (*Gilcrease*).

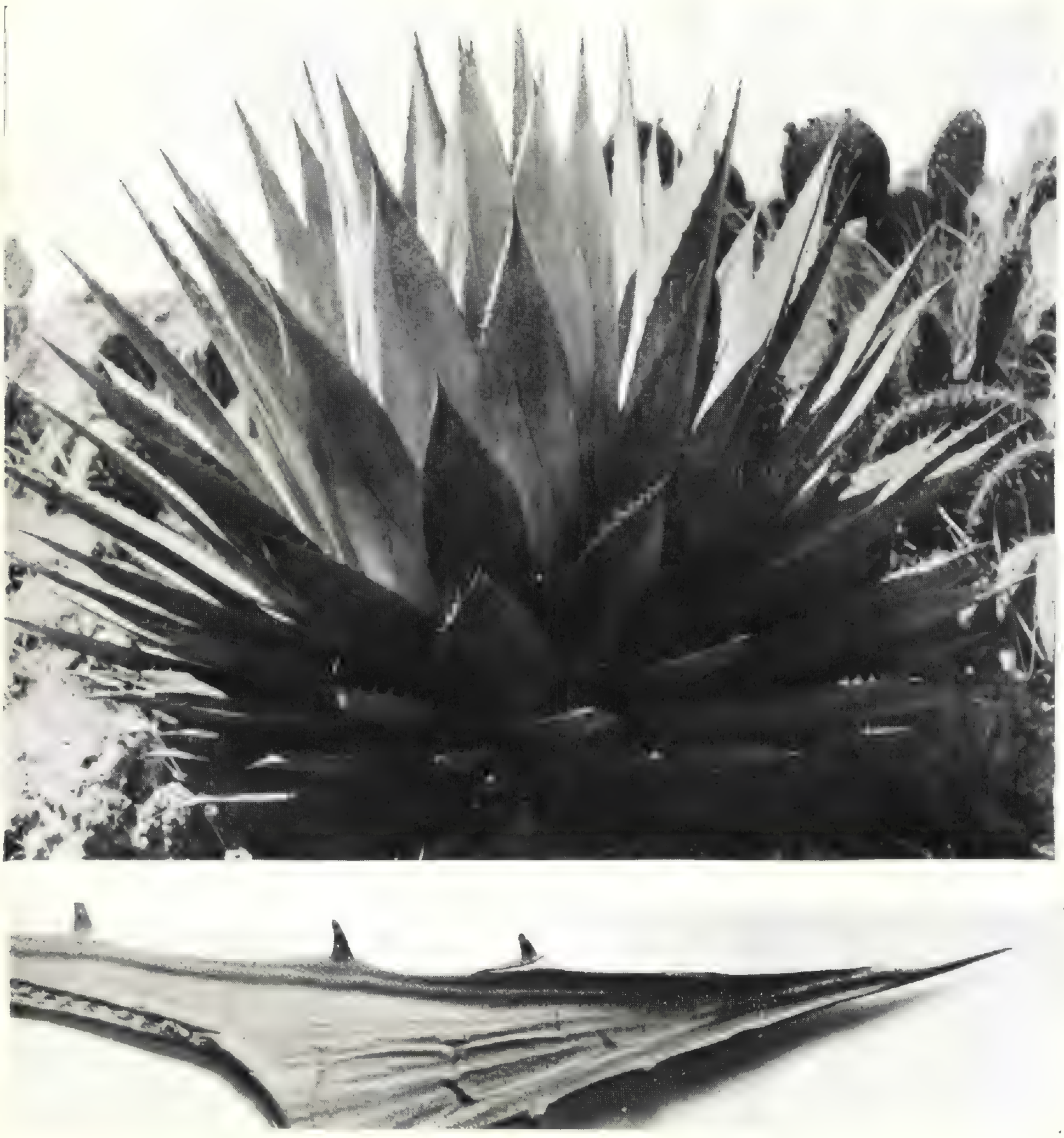
Plate 99.—*Agave gracilipes.* 1, Rough-dried flowers (*Miss Mulford*). 2, Capsules (*Trelease*, 1900). Both from Sierra Blanca.



AGAVE VEXANS.

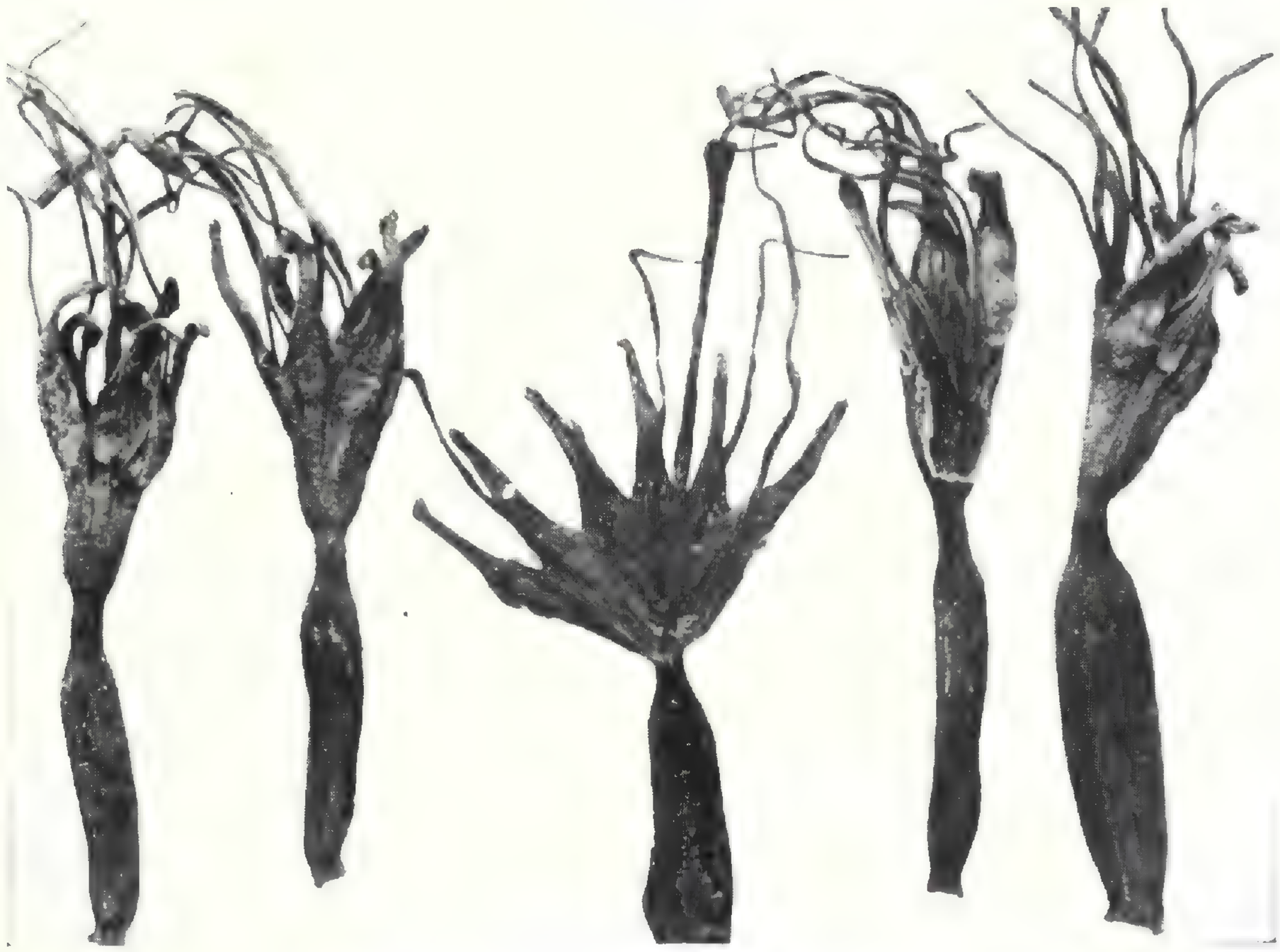


AGAVE APPLANATA.



AGAVE APPLANATA.

AGAVE WISLIZENI.



AGAVE WISLIZENI.

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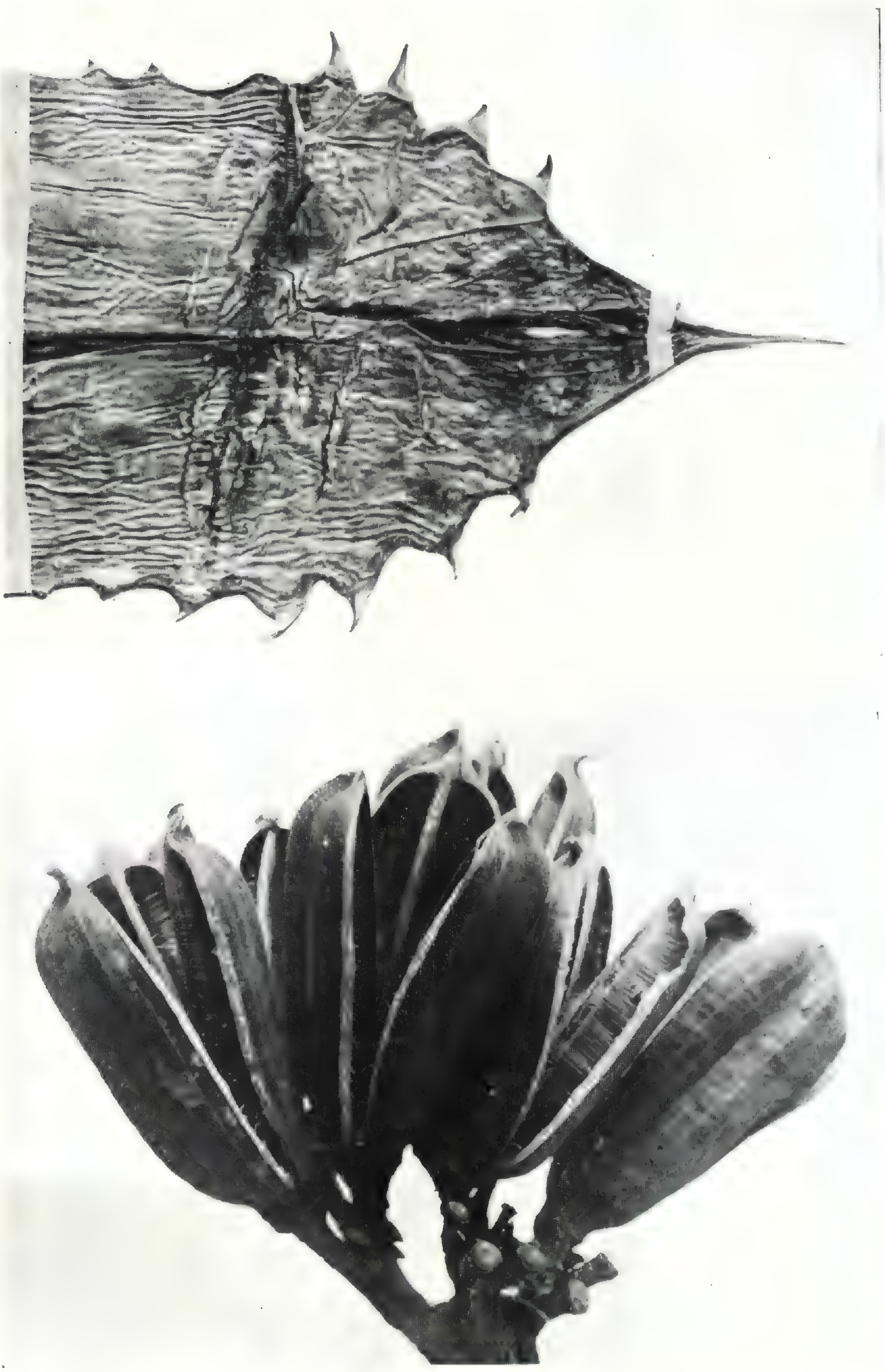
AGAVE WISLIZENI.



AGAVE PARRASANA.

AGAVE PARRASANA.

AGAVE CHIHUAHUANA.

AGAVE CHIHUAHUANA.

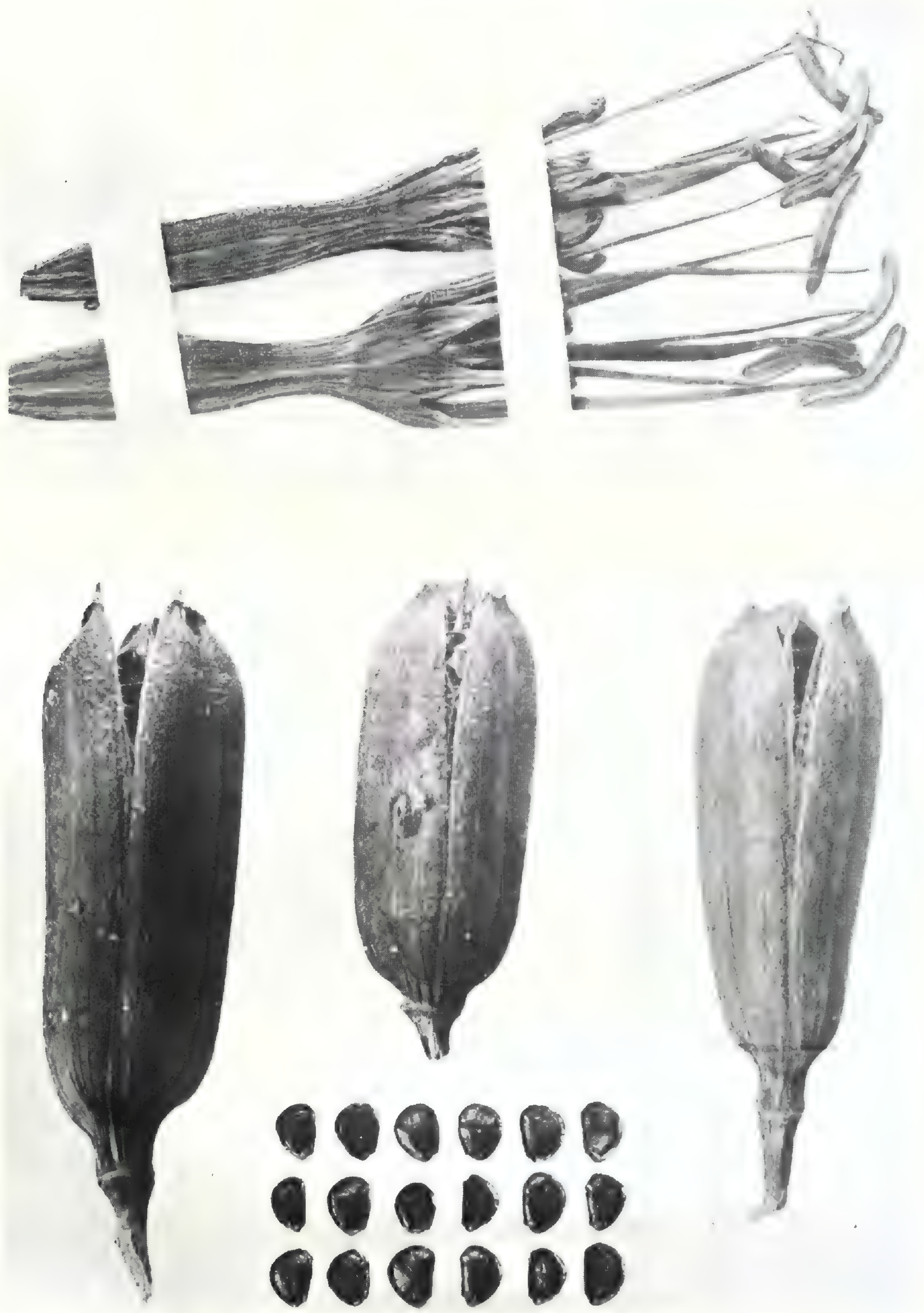
AGAVE HAVARDIANA.

AGAVE HAVARDIANA.

AGAVE HAVARDIANA.

AGAVE HUACHUCENSIS.

AGAVE HUACHUCENSIS.



AGAVE HUACHUCENSIS.

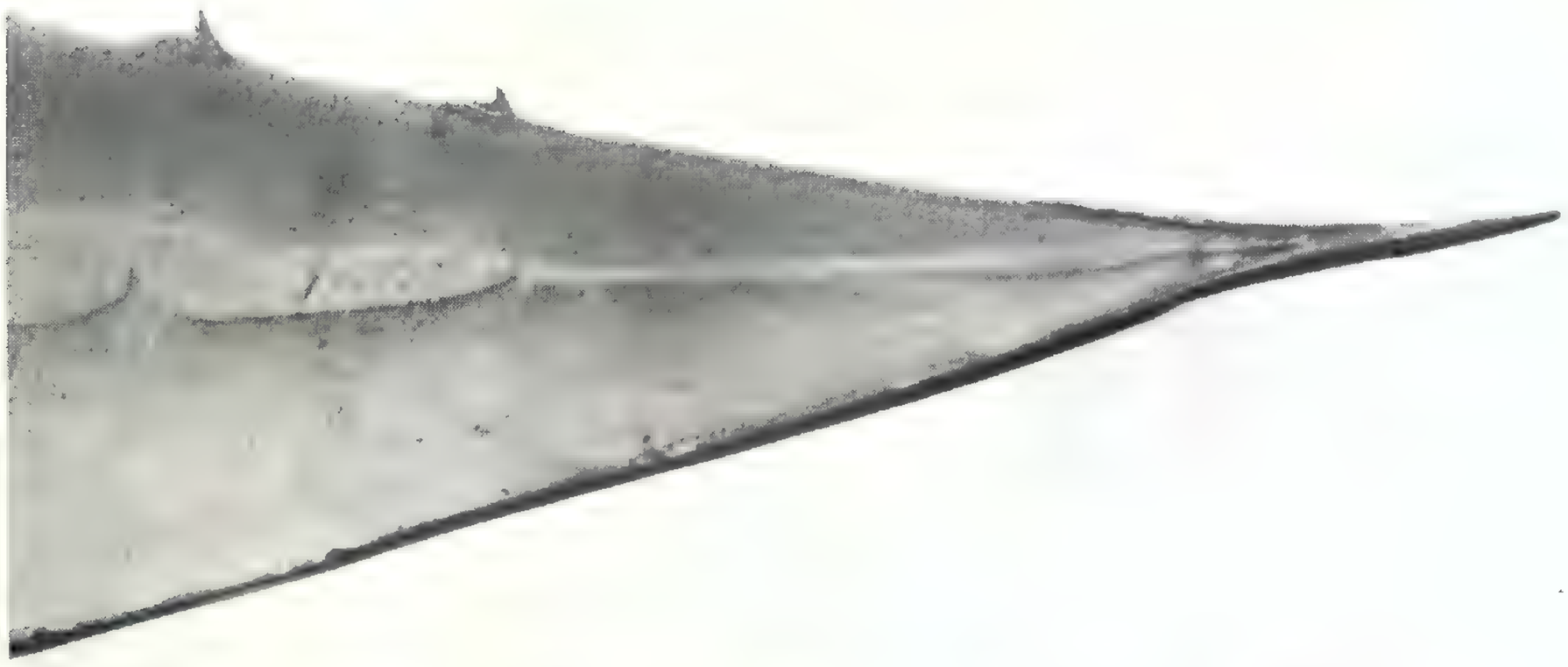
AGAVE PATONII.

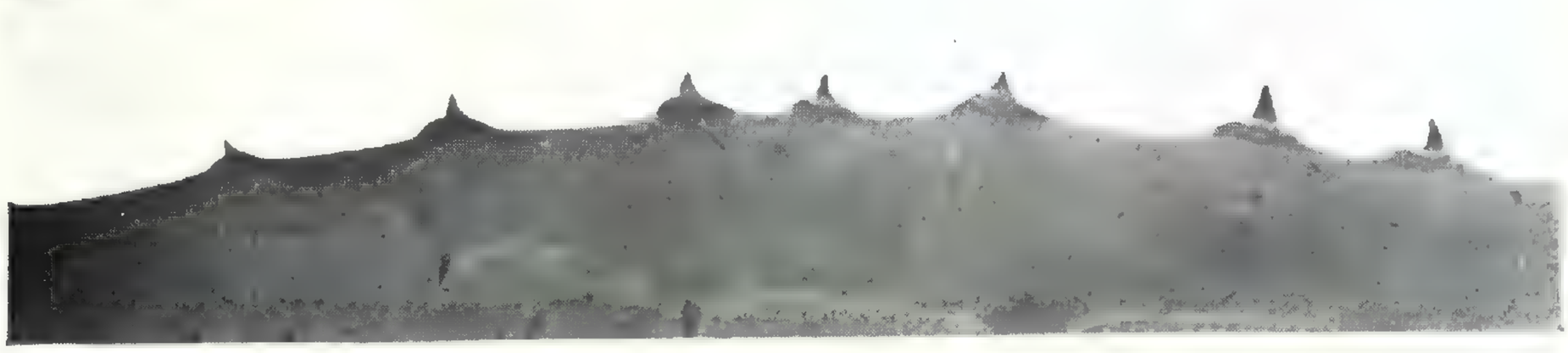
AGAVE PARRYI.

AGAVE PARRYI.

AGAVE PARRYI.

AGAVE COUESII.





AGAVE COUESII.

AGAVE COUESII.

AGAVE GRACILIPES.

AGAVE GRACILIPES.

A DWARF FORM OF AGAVE ANGUSTIFOLIA.

BY WILLIAM TRELEASE.

Among a number of interesting unnamed forms dating from the enthusiastic days of agave cultivation of a generation ago, Professor C. S. Sargent, of Brookline, Mass., presented to the Missouri Botanical Garden in 1909 a little plant obviously of the alliance of *Agave angustifolia* but differing from that species as ordinarily known in its small size and narrowly oblong leaves with reduced prickles, and in not suckering. The flowering of this plant in the summer of 1911 enables me to describe it. Though there is reason to believe that when purchased it bore one of the barely or not at all placeable names under which rarities in this genus were sold thirty years or more ago,—for in appearance it is strikingly different from the usual forms of *Agave Jacquiniana, A. ixtlioides, A. excelsa* or *A. rigida,* as *A. angustifolia* has been called commonly,* I find no means of connecting any published name with it, and therefore take pleasure in naming it for Professor Sargent. So far as is now known, the specimen is unique, but it is certain that others of its kind must have found their way into the collections of amateurs at the time when this was bought, and it will be interesting to learn where it may still be found in cultivation either in such original plants or in derivatives from them, and under what names.

Agave angustifolia Sargentii Trelease.

Dwarf, shortly caulescent, not suckering. Trunk about 25 cm. high. Leaves numerous, spreading, straight, slightly grayish green, smooth, dull, narrowly oblong-lanceolate, 2.5×25 cm., from flatly biconvex becoming shallowly concave toward the end: spine blackish gray, rather dull, minutely granular-roughened, 3×20–25 mm., not decurrent, the upper face flattened or with a low keel: prickles 10–15 mm. apart, nearly black, glossy, 1–2 mm. long, variously but prevailingly up-curved, the very slender cusps from broadly triangular bases,

* See Rept. Mo. Bot. Gard. **19**: 284.

gradually diminishing in size toward the base and apex of the leaf. Inflorescence slightly glaucous, scarcely 1 m. high, with few nearly simple branches at the very top: bracts narrowly triangular, appressed, not widely separated: pedicels scarcely 3 mm. long. Flowers yellowish green, about 40 mm. long: ovary lightly glaucous, 7×18 mm., obconical, somewhat contracted at the top: tube deeply urceolate-conical, 8 mm. deep: segments 4×15–17 mm., quickly drying: filaments inserted nearly in the throat of the tube, sharply inflexed against the style at first, then outwardly ascending, somewhat maroon-dotted like the style, 25 mm. long and about one-half longer than the segments. Fruit? Freely bulbiferous, with the characteristic bulbils of the type.

In appearance and leaf-outline, the vegetating plant closely resembles greener forms of *A. macroacantha,** from which its characteristic ungrooved end-spine sharply distinguishes it. The possibility exists that it may have been distributed under one of the names applied to that species; but the differences in the arming of the leaves are accentuated in its maturity by the very different panicle and flowers. How far the peculiar geniculation of the filaments—not shown in such specimens of *A. angustifolia* as I have seen,* though observable in *A. Cantala* and its closest allies—may be characteristic remains to be ascertained.—*Pl. 100-103.*

EXPLANATION OF PLATES.

Agave angustifolia Sargentii.

Plate 100.—Flowering plant, about one-tenth natural size. The tall plant behind it is *A. Karwinskii*, behind which are pulque magueys (*A. atrovirens*): at the left is a fairly developed plant of the Jaumave ixtle (*A. Funkiana*), and at the right a young henequen (*A. fourcroydes*).

Plate 101.—The same plant somewhat less reduced, with bulbils, in the autumn after flowering,

Plate 102.—Pedicels, flowers and leaf-arming, natural size.

Plate 103.—Bulbils at top of the old inflorescence, natural size.

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* See Rept. Mo. Bot. Gard. 18:247. *pl. 22*, etc.

* Rept. Mo. Bot. Gard. 19: *pl. 34.*

AGAVE ANGUSTIFOLIA SARGENTII.

AGAVE ANGUSTIFOLIA SARGENTII.

AGAVE ANGUSTIFOLIA SARGENTII.

AGAVE ANGUSTIFOLIA SARGENTII.

AN ADDITIONAL TREE-YUCCA AND ONE OTHER SPECIES NEW TO THE UNITED STATES.

BY WILLIAM TRELEASE.

When my revision of the Yucceae was published, in 1902, fragmentary or aberrant specimens collected in the Boundary region about sixty years ago by Bigelow were tentatively referred to *Yucca rostrata.* Of recent years, plants that I cannot distinguish from these, but which appear to be different from though closely allied to *Y. rostrata,* have been collected in western Texas by several botanists and though still incomplete the material that I have seen is sufficient for the characterization of this plant, which is dedicated to Mr. C. H. Thompson of the Missouri Botanical Garden, who has collected it on several occasions.

Yucca Thompsoniana Trelease.

Y. rostrata Trelease, Rept. Mo. Bot. Gard. **13**: 68,—as to the Bigelow collection.

Flowering while stemless but at length caulescent with a trunk about 1 m. high, more or less cespitose. Leaves linear to typically narrowly lanceolate and dagger-like, 4 to mostly 6–10 mm. × 18–25 or exceptionally 35 cm., nearly flat, straight and rigid, bluish and somewhat glaucous, striate, more or less roughened on the back, pungent with a finally brown acicular spine, the minutely denticulate margin bright yellow. Inflorescence about 1 m. high, the upper half or more simply paniculate, more or less evanescently floccose or glabrous. Flowers with segments about 40 mm. long. Fruit capsular, erect, tardily dehiscent, narrowly ovoid, 20 × 40 mm., attenuate above into a slender fragile rather straight beak, the heavily obconical pedicel often bearing the reflexed segments of the dried perianth: exocarp at first waxy with a broad raised line down the rounded back of each carpel: seeds small, 4 × 6 mm., rather thin, dull.

Texas and adjacent Mexico, in the region of the great bend of the Rio Grande, from Devils River to Presidio, Marathon and San Elizario.—*Pl. 104-107.*

Specimens examined:—Below San Elizario (*Bigelow,* June 14, 1852). Bufatello, near Presidio del Norte (*Bigelow,* August 10, 1852,—the type). Los Moros (*Bigelow,* September 23, 1852). Langtry (*Thompson, 156,* 1909). Devils

River (*Griffiths,* 1909). Pecos Viaduct (*Thompson,* 1910). Marathon (*Lloyd, 4,* 1910). Sanderson (*Thompson,* 1911; *Wooton,* 1911).

So closely allied to *Y. Thompsoniana* as to be easily confused with it, is another plant likewise of the group of *Y. rupicola* that differs about as much from the one as it does from the other. This may bear a name commemorative of its collector, the late Mr. Julien Reverchon, an enthusiastic student of the flora of northern and middle Texas, whose herbarium now constitutes an important unit in the large Garden herbarium.

Yucca Reverchoni Trelease.

Acaulescent. Leaves narrowly lanceolate, 12-15 mm. ×30–40 or even 60 cm., nearly flat, straight and rigid, green, at most evanescently a little glaucous, pungent with a slender at first honey-colored spine, the minutely denticulate margin somewhat reddish yellow. Inflorescence scarcely 1 m. high, simply paniculate above, at first whitened with long soft floccose hairs. Flowers with segments 50–60 mm. long. Capsules and seeds?

Western Texas, in the region between *Y. rupicola* and *Y. Thompsoniana.—Pl. 108.*

Specimens examined:—San Angelo (*Reverchon, 4030,* May 20, 1903,—the type). Near Ft. Clark (*Havard, 18,* October, 1883). Comstock (*Thompson,* April 12, 1911).

Accumulated material shows that each species of the *rupicola* alliance may be expected to occur in a form entirely lacking the normally characteristic marginal denticulation of the leaves. At present such smooth-edged forms are known for three of the five species, and for distinction they may be named **Y. rupicola edentata** (Cedar Hill, Dallas Co., Texas, *Reverchon, 968,* June 20, 1903), **Y. rostrata integra** (Hacienda de la Babia, near Sabinas, Coahuila, Mex., *Endlich, 1161,* March 10, 1906*), and **Y. rigida inermis** (Symon, Zacatecas, Mex., *Sra. de Chivo,* June, 1908, received from Professor F. E. Lloyd with the local name Palma San Jose, under his number 77).

* *Cf.* Rept. Mo. Bot. Gard. 18. 226.

EXPLANATION OF PLATES.

Plate 104.—*Yucca Thompsoniana.* 1, Two plants, one nearly acaulescent and the other with a trunk about 4 ft. long. Photographed near Marathon, Texas, by Professor F. E. Lloyd. 2, A cluster of essentially acaulescent plants. Photographed at Langtry, Texas, by Mr. C. H. Thompson.

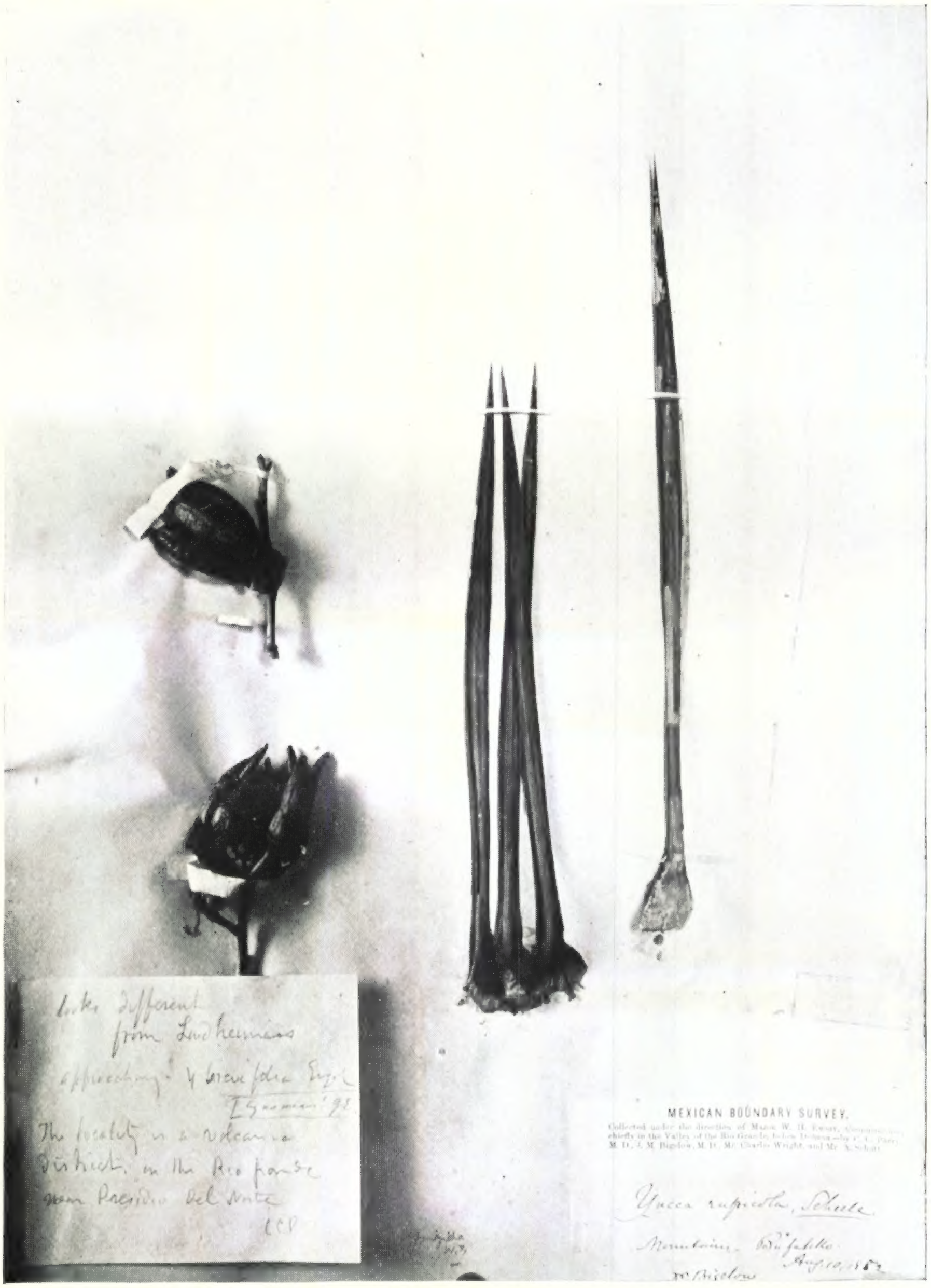
Plate 105.—*Yucca Thompsoniana.* Type sheet, in the herbarium of the New York Botanical Garden. About one-third natural size.

Plate 106.—*Yucca Thompsoniana.* Part of a fruiting inflorescence, from the Pecos (*Thompson*). Natural size.

Plate 107.—1, *Yucca Thompsoniana.* 2, *Y. rupicola.* Capsules and seeds, natural size.

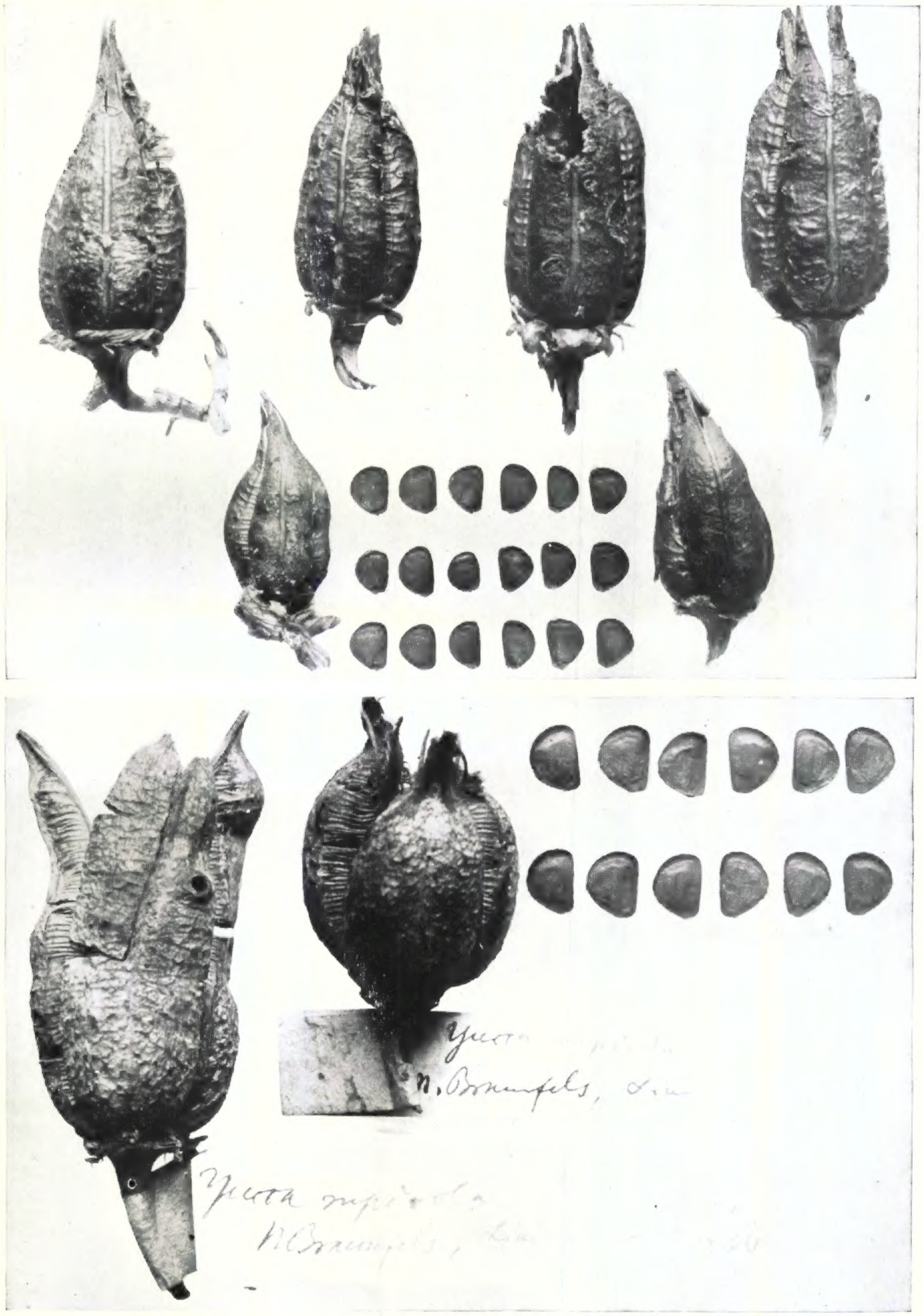
Plate 108.—*Yucca Reverchoni.* 1, Flowers of the type collection. 2, Narrow leaf fragment and part of young panicle (*Thompson*).

YUCCA THOMPSONIANA.

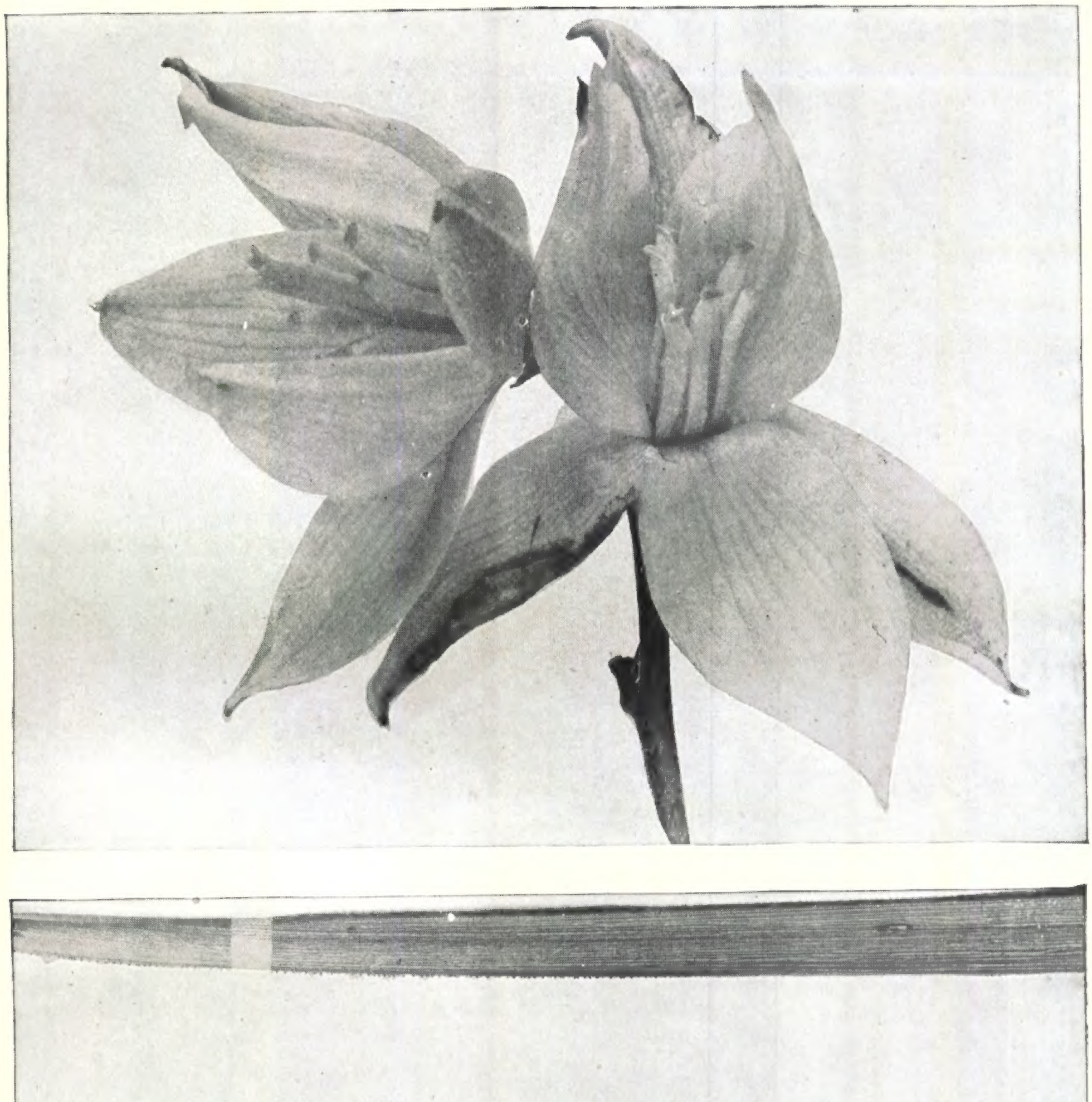


YUCCA THOMPSONIANA.

YUCCA THOMPSONIANA.



YUCCA THOMPSONIANA AND Y. RUPICOLA.



YUCCA REVERCHONI.